PALÆONTOGRAPHICAL SOCIETY.

VOL. LXVIII.

THE PLIOCENE MOLLUSCA OF GREAT BRITAIN.

PART II.

PAGES 201—302; PLATES XXV—XXXII.

ISSUED FOR 1914.

California Academy of Sciences

RECEIVED BY PURCHASE

21804

Digitized by the Internet Archive
in 2011 with funding from
California Academy of Sciences Library

http://www.archive.org/details/monographof681914pala

PALÆONTOGRAPHICAL SOCIETY.

VOLUME LXVIII.

CONTAINING

1. THE PLIOCENE MOLLUSCA. Part II. By Mr. F. W. Harmer. Eight Plates.

ISSUED FOR 1914.

LONDON:
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

AGENTS FOR THE SOCIETY
DULAU AND CO., LTD., 37, SOHO SQUARE, W.

JULY, 1915.

THE PALÆONTOGRAPHICAL SOCIETY was established in the year 1847, for the purpose of figuring and describing British Fossils.

Each person subscribing ONE GUINEA *is considered a Member of the Society, and is entitled to the Volume issued for the Year to which the Subscription relates. The price of the Volume to Non-subscribers is* TWENTY-FIVE SHILLINGS NET.

Subscriptions are considered to be due on the 1st of January in each year.

The Annual Volumes are now issued in *two forms of Binding:* 1st, with all the Monographs stitched together and enclosed in one cover; 2nd, with each of the Monographs in a paper cover, and the whole of the separate parts enclosed in an envelope. Members wishing to obtain the Volume arranged in the LATTER FORM are requested to communicate with the Secretary.

Most of the *back volumes* are in stock. Monographs or parts of Monographs already published can be obtained, apart from the annual volumes, from Messrs. DULAU AND CO., LTD., 37, Soho Square, London, W., who will forward a complete price list on application.

Members desirous of forwarding the objects of the Society can be provided with plates and circulars for distribution on application to the Secretary, Dr. A. SMITH WOODWARD, British Museum (Nat. Hist.), South Kensington, London, S.W.

The following Monographs are in course of preparation and publication :

The Graptolites, by Prof. Lapworth, Miss Elles, and Miss Wood.

The Cambrian Trilobites, by Mr. Philip Lake.

The Palæozoic Asterozoa, by Mr. W. K. Spencer.

The Ordovician and Silurian Mollusca, by Dr. Wheelton Hind.

The Pliocene Mollusca, by Mr. F. W. Harmer.

The Pleistocene Mammalia, by Prof. S. H. Reynolds.

The Wealden and Purbeck Fishes, by Dr. A. Smith Woodward.

GeolLibrary
QE 701
.P29

ANNUAL REPORT

OF THE

PALÆONTOGRAPHICAL SOCIETY, 1914,

WITH

LIST

OF

The Council, Secretaries, and Members

AND

A LIST OF THE CONTENTS OF THE VOLUMES ALREADY PUBLISHED.

Council and Officers elected March, 1914.

President.

HENRY WOODWARD, Esq., LL.D., F.R.S., F.G.S.

Vice-Presidents.

Rev. Canon Bonney, D.Sc., F.R.S.
Sir Archibald Geikie, O.M., K.C.B., F.R.S.
G. J. Hinde, Esq., Ph.D., F.R.S.
E. T. Newton, Esq., F.R.S.

Council.

H. A. Allen, Esq., F.G.S.
C. W. Andrews, Esq., D.Sc., F.R.S.
G. Barrow, Esq., F.G.S.
F. A. Bather, Esq., D.Sc., F.R.S.
Miss M. C. Crosfield.
H. Dewey, Esq., F.G.S.
Walcot Gibson, Esq., D.Sc., F.G.S.
F. L. Kitchin, Esq., M.A., Ph.D., F.G.S.
Bishop Mitchinson, D.D., D.C.L.
A. W. Oke, Esq., LL.M., F.G.S.
F. R. Cowper Reed, Esq., M.A., Sc.D., F.G.S.
Dr. Arthur W. Rowe, F.G.S.
W. K. Spencer, Esq., M.A., F.G.S.
A. Strahan, Esq., Sc.D., F.R.S.
Prof. W. W. Watts, D.Sc., F.R.S.

Treasurer.

R. S. Herries, Esq., M.A., F.G.S.

Secretary.

A. Smith Woodward, Esq., LL.D., F.R.S., British Museum (Nat. Hist.), South Kensington, London. S.W.

Local Secretaries.

Bath—Rev. H. H. Winwood, M.A., F.G.S.
Berlin—Messrs. Friedländer & Son.
Cambridge—H. Woods, Esq., M.A., F.G.S.
Hertfordshire—J. Hopkinson, Esq., F.G.S.
Oxford—Prof. W. J. Sollas, F.R.S.
Staffordshire—Dr. Wheelton Hind, F.G.S.

ANNUAL REPORT OF THE COUNCIL

FOR THE YEAR ENDING 31ST DECEMBER, 1913.

READ AND ADOPTED AT THE

ANNUAL GENERAL MEETING,

HELD AT THE APARTMENTS OF THE GEOLOGICAL SOCIETY, BURLINGTON HOUSE, 27TH MARCH, 1914.

DR. HENRY WOODWARD, F.R.S., PRESIDENT,

IN THE CHAIR.

THE COUNCIL, in presenting their Sixty-seventh Annual Report, have pleasure in recording another year's successful work. The volume for 1913 contains a further instalment of the monograph of "British Graptolites," by Miss Elles and Miss Wood (Mrs. Shakespear), and a Supplement to the "Lower Palæozoic Trilobites of Girvan," by Dr. F. R. Cowper Reed, besides title-pages and indexes for the "Ganoid Fishes of the British Carboniferous Formations" and "Fishes of the Old Red Sandstone," by the late Dr. R. H. Traquair. Two new monographs are also begun, one on the "Palæozoic Asterozoa," by Mr. W. K. Spencer, the other on the "Pliocene Mollusca," by Mr. F. W. Harmer. The illustrations are more numerous than usual, the total number of plates being thirty-six, and that of the text-figures also considerable.

As in the two previous years, the volume was again delayed by unforeseen difficulties in the preparation of the contributions, and it was not ready for distribution until the end of February, 1914. The analysis of the balance-sheet for the year, therefore, presents some difficulty; but it is clear that the total cost of the volume for 1913 will much exceed the income for the year to which it relates, and the savings of the past five years will be encroached upon. The

Council, however, have been able to provide more illustrations than usual through the generosity of Mrs. Gray, who gave the sum of £61 4*s.* 0*d.* for the preparation of the eight plates of Girvan Trilobites, and through the promise of a contribution from Mr. F. W. Harmer towards the cost of production of the plates of Pliocene Mollusca. They are also indebted to Mrs. Shakespear for the drawings of text-figures of Graptolites. Thanks are due to all these benefactors.

Among the members who have died during the past year the Council desire especially to refer to the Rt. Hon. Lord Avebury, Dr. Tempest Anderson, and Mr. W. H. Sutcliffe. Lord Avebury was among the oldest supporters of the Society, and during recent years Mr. Sutcliffe had done much for the progress of palæontological discovery in Lancashire and Yorkshire. To replace the numerous losses recently sustained, the Council would welcome the help and personal influence of the members in making the work and needs of the Society more widely known among those who are interested in the study of fossils. During recent years there has unfortunately been a steady decrease in the number of subscribers.

The thanks of the Society are due to the Council of the Geological Society for permission both to store the stock of back volumes, and to hold the Council Meetings and Annual General Meeting in their apartments.

In conclusion, the Council much regret to have to record the retirement of the Treasurer, Dr. George J. Hinde, F.R.S., after ten years of highly valued service. Dr. Hinde first joined the Council in 1897, and special thanks are due to him for the untiring efforts he has made for the welfare of the Society.

It is proposed that the retiring members of the Council be Miss Johnston, Prof. Garwood, Mr. Knipe, and Prof. Sollas; that the new members be Bishop Mitchinson, Dr. F. A. Bather, Mr. R. S. Herries, and Mr. W. K. Spencer; that the President be Dr. Henry Woodward; the Treasurer, Mr. R. S. Herries; and the Secretary, Dr. A. Smith Woodward.

Annexed is the Balance-sheet.

THE PALÆONTOGRAPHICAL SOCIETY IN ACCOUNT WITH DR. GEORGE J. HINDE, F.R.S., TREASURER.

Cr. *From January 1st, 1913, to December 31st, 1913.* *Dr.*

		£	s.	d.	£	s.	d.
Balance from last Account					603	6	3
Members' Subscriptions—1908–1911	13	13	13	0			
,, ,,	1912	108	113	8	0		
,, ,,	1913	257½	270	7	6		
,, ,,	1914	5	5	5	0		
		383½			402	13	6
Carriage paid by Members					2	3	4
Sales of back stock to Members					7	5	6
Sales by Messrs. Dulau & Co., Ltd.					97	18	7
Donation from Mrs. Gray					61	4	0
Dividends on £500 Natal 3 per cent. Stock (less income tax)					14	2	6
Repaid Income Tax (1 year)					0	17	6
Interest on Deposit					16	5	8
					£1205	16	10

	£	s.	d.	£	s.	d.
Letterpress printing (Vols. LXVI and LXVII)	291	2	9			
Paper	51	8	1			
				342	10	10
Drawing and engraving illustrations	247	16	7			
Collotype printing and blocks	126	4	0			
				374	0	7
Binding (Vol. LXVI)				33	16	1
Packing and distribution				14	14	11
Secretary's honorarium				52	10	0
Postage and stationery				6	0	9
Printed Notice Cards, etc.				1	3	3
Back Stock purchased to complete set				1	10	0
Premium Fire Insurance				0	15	0
Petty charges—Porter	0	15	0			
Bank	0	7	2			
				1	2	2
Balance at Bank—Current Account	22	8	3			
Balance at Bank—Deposit Account	350	0	0			
				372	8	3
Cheques in hand				5	5	0
				£1205	16	10

We have examined the above account, compared it with the vouchers, and find it to be correct; we have also seen the receipt for £500 Natal 3 per cent. Consolidated Stock.

March 12th, 1914.

HENRY A. ALLEN,
H. N. HUTCHINSON,
E. T. NEWTON,
GEORGE W. YOUNG. } Auditors.

LIST OF MEMBERS.*

CORRECTED TO 1st DECEMBER, 1914.

Aberdeen, University Library.
Aberystwith, National Library of Wales.
Adelaide (Australia) Public Library.
Adlard, R. E., Esq., Bartholomew Close. E.C.
Allen, Messrs. E. G. & Son, King Edward Mansions, 14, Grape Street, Shaftesbury Avenue. W.C.
Allen, H. A., Esq., F.G.S., 28, Jermyn Street. S.W.
Amsterdam, Royal Academy of Sciences.
Andrews, C. W., Esq., D.Sc., F.R.S., British Museum (Nat. Hist.), South Kensington. S.W.
Arlecdon and Frizington Public Library, Frizington, Cumberland.
Asher and Co., Messrs., 13, Bedford Street, Covent Garden. W.C.

Bâle (Switzerland), University Library.
Balston, W. E., Esq., F.G.S., Barvin, Potter's Bar.
Banks, W. H., Esq., Hergest Croft, Kington, Herefordshire.
Barclay, F. H., Esq., F.G.S., The Warren, Cromer, Norfolk.
Barnes, J., Esq., F.G.S., South Cliff House, Higher Broughton, Manchester.
Barrow, George, Esq., F.G.S., 28, Jermyn Street. S.W.
Bath, Royal Literary and Scientific Institution.
Bather, F. A., Esq., M.A., D.Sc., F.R.S., British Museum (Nat. Hist.). S.W.
Battersea Public Library, Lavender Hill. S.W.
Bedford, His Grace the Duke of, K.G., F.R.S., Woburn Abbey, Bedfordshire.
Belfast Linen Hall Library, Donegall Square North, Belfast.
Belfast, Queen's University.
Bell, W. Heward, Esq., F.G.S., Cleeve House, Seend, Melksham.
Bergen (Norway), Museums Bibliothek.
Berlin, Geological Library of Royal School of Mines, 44, Invalidenstrasse.
Birkenhead Public Library, Birkenhead.

* Members are requested to inform the Secretary of any errors or omissions in this list, and of any delay in the transmission of the Yearly Volumes.

Birmingham Central Public Library, Ratcliff Place, Birmingham.
Birmingham Library, Margaret Street, Birmingham.
Birmingham University Library.
Blackburn Public Library, Blackburn.
Blackmore, Humphrey P., Esq., M.D., F.G.S., Salisbury.
Blathwayt, Lieut.-Col. Linley, Eagle House, Batheaston, Bath.
Blundell, Harold, Esq., Fairlawn, Harpenden, Herts.
Bolton, Chadwick Museum.
Bonn (Germany), Geological-Palæontological Institute of the University.
Bonney, Rev. Canon T. G., D.Sc., F.R.S., *Vice-President*, 9, Scroope Terrace, Cambridge.
Bootle-cum-Linacre Public Library, Bootle, Liverpool.
Boston Society of Natural History, Boston, Mass., U.S.A.
Boston Public Library, Boston, Mass., U.S.A.
Bournemouth Natural Science Society.
Bradley, F. L., Esq., F.G.S., Ingleside, Malvern Wells.
Brighton and Hove Natural History Society, Brighton.
Bristol Naturalists' Society, Geological Section, *per* B. A. Baker, Esq., Henbury House, Henbury, near Bristol.
Bristol Central Public Library.
Bristol Museum of Natural History, Queen's Road, Bristol.
Bristol University Library.
Bromley Naturalists' Society, 92, London Road, Bromley, Kent.
Brown, Alexander Oestrand, Esq., B.A., F.G.S., Covadonga, Asturias, Spain.
Brydone, R. M., Esq., F.G.S., The Stock Exchange, London.
Burr, Malcolm, Esq., D.Sc., F.L.S., F.G.S., Eastry, Kent.
Burrows, Henry W., Esq., F.G.S., 17, Victoria Street. S.W.
Burslem Public Library, Burslem.
Buxton Public Library, Town Hall, Buxton.

Calcutta, Geological Survey of India.
Cambridge Philosophical Society's Library, New Museums, Cambridge.
Cambridge, St. John's College.
Cambridge, Sidney Sussex College.
Cambridge, University Library.
Cambridge, Sedgwick Museum.
Canadian Geological Survey, Sussex Street, Ottawa, Canada.
Cardiff, National Museum of Wales.
Cardiff Public Library, Cardiff.
Cardiff, University College of South Wales and Monmouthshire.
Carlisle Public Library, Carlisle.
Carruthers, R. G., Esq., F.G.S., 33, George Square, Edinburgh.
Chelsea Public Library, Manresa Road. S.W.
Cheltenham College, Cheltenham.
Chester Society of Natural Science, Chester.
Chicago (U.S.A.), University Library.
Chiswick Public Library, Chiswick. W.
Christiania (Norway), University Library.
Clarke, Mrs. Stephenson, Brook House, Haywards Heath, Sussex.

Clifton College, Clifton, Bristol.
Clough, C. T., Esq., M.A., F.G.S., 28, Jermyn Street. S.W.
Cobbold, E. S., Esq., F.G.S., All Stretton, Church Stretton, R.S.O., Shropshire.
Codd, J. Alfred, Esq., M.D., B.Sc., F.G.S., 7, Tettenhall Road, Wolverhampton.
Cooper, C. Forster, Esq., M.A., The End House, Fulbrooke Road, Cambridge.
Cornell University, Ithaca, U.S.A.
Coventry Public Library, Coventry.
Crosfield, Miss Margaret C., Undercroft, Reigate.
Crosse, Miss, The Yew House, Caterham Valley, Surrey.
Croydon Central Public Library, Town Hall, Croydon.
Cunnington, C. H., Esq., F.G.S., 28, Jermyn Street. S.W.

Darwin, the late W. E., Esq., F.G.S., 11, Egerton Place. S.W.
Dawkins, Prof. W. Boyd, D.Sc., F.R.S., F.G.S., Fallowfield House, Fallowfield, Manchester.
Dawson, Messrs. W., and Sons, St. Dunstan's House, Fetter Lane. E.C.
Deane, Henry, Esq., F.L.S., Campsie, 14, Mercer Road, Malvern, Victoria, Australia.
Derby Public Library and Museum, Derby.
Devonport Public Library, Devonport.
Dewey, Henry, Esq., F.G.S., 28, Jermyn Street. S.W.
Dixon, E. E. L., Esq., B.Sc., F.G.S., 28, Jermyn Street. S.W.
Dorset County Museum Library, Dorchester.
Drake, Henry C., Esq., F.G.S., 10, Oak Road, Scarborough.
Dublin, National Library.
Dublin, Royal College of Science for Ireland, Stephen's Green.
Dublin, Royal Irish Academy, 19, Dawson Street.
Dublin, Trinity College.
Ducie, Right Hon. Earl of, F.R.S., Tortworth Court, Gloucestershire.
Dundee Free Library, Dundee.

Edinburgh Geological Society, 69a, George Street, Edinburgh.
Edinburgh, Royal Scottish Museum, Chambers Street, Edinburgh.
Edinburgh Public Library, Edinburgh.
Edinburgh, Royal Society.
Edinburgh, University Library.
Epsom College, Epsom.
Erlangen (Germany), Mineralogical-Geological Institute of the University.
Eton College, Windsor, *per* M. D. Hill, Esq., M.A.
Exeter, Royal Albert Memorial Public Library, Queen Street.

Folkestone Public Library and Museum, Folkestone.
Foulerton, Dr. J., 44, Pembridge Villas, Bayswater. W.
Frankfurt-am-Main (Germany), Senckenbergische Naturforschende Gesellschaft.
Friedländer, Messrs., 11, Carlstrasse, Berlin.
Fuller, Rev. A., M.A., The Lodge, 7, Sydenham Hill. S.E.

Galashiels, N.B., Public Library.
Galway, University College.
Garwood, Prof. E. J., M.A., F.R.S., F.G.S., University College, Gower Street. W.C.
Gateshead-on-Tyne Public Library, Gateshead-on-Tyne.
Geikie, Sir Archibald, O.M., K.C.B., LL.D., F.R.S., *Vice-President*, Shepherd's Down, Haslemere, Surrey.
Gibson, Miss, Hill House, Saffron Walden.
Gibson, Ernest, Esq., F.L.S., F.G.S., 25, Cadogan Place. S.W.
Gibson, Walcot, Esq., D.Sc., F.G.S., 28, Jermyn Street. S.W.
Gilmour, M., Esq., F.Z.S., Saffronhall House, 1, Windmill Road, Hamilton. N.B.
Glasgow, Geological Society, 150, Hope Street.
Glasgow, Mitchell Library, North Street.
Glasgow, Royal Philosophical Society, 207, Bath Street.
Glasgow, Kelvingrove Museum.
Glasgow, University Library.
Gloucester Free Public Library.
Gotha (Germany), Herzogliche Bibliothek.
Great Yarmouth Public Library.
Green, Upfield, Esq., F.G.S., 8, Bramshill Road, Harlesden. N.W.
Greenly, Edward, Esq., F.G.S., Achnashean, near Bangor.
Gregory, Prof. J. W., D.Sc., F.R.S., The University, Glasgow.

Haileybury College, near Hertford.
Halifax Public Library, Halifax.
Halle (Germany), University Library.
Hammersmith Carnegie (Central) Library, Hammersmith. W.
Hampstead Public Library, Finchley Road, Hampstead. N.W.
Harker, Alfred, Esq., M.A., F.R.S., St. John's College, Cambridge.
Harley, Dr. John, F.L.S., Beedings, Pulborough, Sussex.
Harmer, F. W., Esq., F.G.S., Oakland House, Cringleford, near Norwich.
Hastings Public Library.
Hawick Public Library, Hawick. N.B.
Hawkins, Herbert L., Esq., M.Sc., F.G.S., University College, Reading.
Heidelberg (Germany), University Library.
Heron-Allen, Edward, Esq., F.L.S., F.G.S., Large Acres, Selsey Bill, Sussex.
Herries, Robert S., Esq., M.A., F.G.S., *Treasurer*, St. Julian's, Sevenoaks, Kent.
Hill, Rev. Edwin, M.A., F.G.S., The Rectory, Cockfield, Bury St. Edmunds.
Hind, Wheelton, Esq., M.D.Lond., F.R.C.S., F.G.S., *Local Secretary*, Roxeth House, Stoke-on-Trent.
Hinde, Geo. J., Esq., Ph.D., F.R.S., *Vice-President*, 24, Avondale Road, South Croydon.
Hodges, Isaac, Esq., F.G.S., Vereeniging, Transvaal.
Hodges, Figgis, and Co., 104, Grafton Street, Dublin.
Holcroft, Sir Charles, The Shrubbery, Summerhill, Kingswinford, near Dudley.
Hooley, R. W., Esq., F.G.S., Earlescroft, St. Giles' Hill, Winchester.
Hopkinson, John, Esq., F.L.S., F.G.S., *Local Secretary*, Weetwood, Watford.
Hove Public Library, Hove, Brighton.
Howse, the late Sir Henry G., M.S., F.R.C.S., The Tower House, Cudham, near Sevenoaks, Kent.

Hughes, Prof. T. M'Kenny, M.A., F.R.S., Sedgwick Museum, Cambridge.
Hull Public Library, Hull.
Hutchinson, Rev. H. N., M.A., F.G.S., 17, St. John's Wood Park, Finchley Road. N.W.
Hutton, Miss H. Mary, Putney Park, Putney Park Lane. S.W.

Ipswich Central Public Library, High Street, Ipswich.
Isle of Man Natural History Society, Ramsey, Isle of Man.

Jaekel, Prof. Otto, Geological Institute, University, Greifswald, Germany.
Johnes, Lady E. Hills, Dolau Cothy, Llandeilo, R.S.O., South Wales.
Johns Hopkins University, Baltimore, U.S.A.
Johnston, Miss Mary S., Hazlewood, Wimbledon Hill. S.W.
Jones, E. Lloyd, Esq., M.D., 59, Trumpington Street, Cambridge.
Jones, Prof. O. T., M.A., F.G.S., University College, Aberystwyth.
Jukes-Browne, the late A. J., Esq., B.A., F.R.S, F.G.S., Westleigh, Torquay.

Kettering Public Library, Kettering.
Kilmarnock Public Library, Kilmarnock. N.B.
King, W. Wickham, Esq., F.G.S., Winds Point, Hagley, near Stourbridge.
Kirkcaldy Naturalists' Society; John G. Low, Esq., 228, High Street, Kirkcaldy. N.B.
Kitchin, F. L., Esq., M.A., Ph.D., F.G.S., Geol. Survey of England, 28, Jermyn Street. S.W.
Knipe, H. R., Esq., F.L.S., F.G.S., 9, Linden Park, Tunbridge Wells.

Lake, P., Esq., M.A., F.G.S., St. John's College, Cambridge.
Lancaster Public Library, Lancaster.
Lang, W. D., Esq., M.A., F.G.S., British Museum (Nat. Hist.), South Kensington. S.W.
Lapworth, Prof. Charles, LL.D., F.R.S., 38, Calthorpe Road, Edgbaston, Birmingham.
Lausanne (Switzerland) Cantonal Library.
Leeds Philosophical and Literary Society, Leeds.
Leeds Public Library, Leeds.
Leeds, University Library.
Leek, Staffordshire, Nicholson Institute.
Leicester Town Museum, Leicester.
Leipzig (Germany), University Library.
Leyton Public Library, Leyton. N.E.
Liège (Belgium), Geological Laboratory of the University.
Lille (France), Geological Laboratory of the University, 159, Rue Brûle-Maison.
Lisbon, Geological Survey of Portugal.
Lissajous, Mons. M., 10, Quai des Marans, Mâcon, France.
Liveing, Professor G. D., M.A., F.R.S., Cambridge.
Liverpool, Athenæum Library.
Liverpool, Public Library.
Liverpool, Geological Society of.
London, Imperial College of Science, South Kensington. S.W.

London, British Museum, Bloomsbury. W.C.
London, British Museum (Nat. Hist.), Cromwell Road. S.W.
London, Corporation of, Library Committee of, Guildhall. E.C.
London, Geological Society, Burlington House. W.
London, King's College, Strand. W.C.
London, Linnean Society, Burlington House, Piccadilly. W.
London, Museum of Practical Geology, Jermyn Street. S.W.
London, Royal College of Surgeons, Lincoln's Inn Fields. W.C.
London, Royal Institution of Great Britain, Albemarle Street. W.
London, Royal Society of, Burlington House. W.
London, St. Martin's-in-the-Fields Public Library, 115, St. Martin's Lane, W.C.
London, Science Museum, South Kensington. S.W.
London, Surveyors' Institution, 12, Great George Street, Westminster. S.W.
London, University College, Gower Street. W.C.
London, Zoological Society, Regent's Park. N.W.
Longstaff, Mrs., Highlands, Putney Heath. S.W.
Lund (Sweden), University Library.
Lydekker, Richard, Esq., F.R.S., The Lodge, Harpenden, Herts.
Lyons, Capt. H. G., D.Sc., F.R.S., Science Museum, South Kensington. S.W.

McNeill, Bedford, Esq., F.G.S., Greenholme, Claygate, Surrey.
Madras Government Museum, *per* Messrs. Baker and Co., 6, Bond Court, Walbrook. E.C.
Maidstone Museum, *per* Brenchley Trustees, Maidstone.
Manchester Public Library.
Manchester, Geological Society of, 5, John Dalton Street, Manchester.
Manchester Literary and Philosophical Society, 36, George Street, Manchester.
Marburg (Germany), University of.
Marr, J. E., Esq., M.A., Sc.D., F.R.S., St. John's College, Cambridge.
Mawby, William, Esq., 7, Cross Street, Birkenhead.
Melbourne Public Library.
Melbourne, Dept. Mines, Geological Survey Branch.
Mennell, H. T., Esq., F.L.S., The Red House, Croydon.
Metcalfe, Henry F., Esq., Cyprus House, Exmouth.
Middlesbrough Public Library.
Milan (Italy), Societa Italiana di Scienze Naturali, Palazzo del Museo Civico.
Mitchinson, Rt. Rev. J., D.C.L., D.D., Canon of Gloucester and Master of Pembroke College, Oxford.
Mond, Robert, Esq., M.A., F.R.S.E., F.G.S., The Elms, Avenue Road, St. John's Wood. N.W.
Munich (Germany), Alte Akademie, Geologisches Museum.
Munich Royal Library.

Neumeyer, Dr. Max, Halle-a.-d.-Saale (Germany)
New South Wales, Royal Society of, Sydney.
New York (U.S.A.) Public Library.

Newcastle-on-Tyne, Armstrong College.
Newcastle-on-Tyne, Literary and Philosophical Society of, Westgate Street, Newcastle-on-Tyne.
Newcastle-on-Tyne Public Library.
Newport Public Library, Newport, Monmouthshire.
Newton, E. T., Esq., F.R.S., *Vice-President*, Florence House, Willow Bridge Road, Canonbury. N.
Noble, Arthur H., Esq., P.O. Box 238, Tampico (Tamaulipas), Mexico.
North Devon Athenæum, Barnstaple.
North Staffordshire Field Club, Stone, Staffordshire.
Northampton Natural History Society, Northampton.
Northumberland, His Grace the Duke of, K.G., F.R.S., Alnwick Castle.
Norwich Public Library.
Nottingham Public Library.

Odling, M., Esq., M.A., B.Sc., F.G.S., University, Leeds.
Oke, Alfred W., Esq., F.G.S., 32, Denmark Villas, Hove, Sussex.
Oldham Public Library.
Oswestry Public Library.
Oxford, Bodleian Library.
Oxford, Radcliffe Library.

Paisley Philosophical Institution.
Paris, École des Mines.
Paris, Geological Society of France, 7, Rue des Grands Augustins.
Paris, Muséum National d'Histoire Naturelle, Laboratoire de Paléontologie.
Paris, Sorbonne, Laboratoire de Géologie.
Part, G. M., Esq., F.G.S., Trinity College, Cambridge.
Peabody Institute, Salem, Mass., U.S.A.
Penzance, Royal Geological Society of Cornwall.
Peterborough Natural History, Scientific, and Archæological Society.
Philadelphia (U.S.A.), Academy of Natural Sciences.
Pittsburgh (U.S.A.), Carnegie Museum.
Plymouth Public Library.
Plymouth Institution, Library of, Athenæum, Plymouth.
Pocock, R. W., Esq., B.Sc., F.G.S., 28, Jermyn Street, S.W.
Poole Public Library.
Portis, Dr. A., Professor of Geology, The University, Rome.
Portsmouth Public Library.
Power, Edward John, Esq., F.G.S., 25, Ashburn Place, South Kensington. S.W.
Prague (Bohemia), Royal Geological Institution of the German Carl Ferdinand University.
Preston Public Library.
Pryor, M. R., Esq., Weston Manor, Stevenage, Herts.

Queensland Museum, Brisbane.

Reading, University College.
Reed, F. R. Cowper, Esq., M.A., Sc.D., F.G.S., Gaultier, Madingley Road, Cambridge.
Reid, Clement, Esq., F.R.S., One Acre, Milford-on-Sea, Hants.
Reynolds, Prof. S. H., M.A., F.G.S., University, Bristol.
Rochdale Public Library.
Rogers, Arthur W., Esq., D.Sc., F.G.S., Cape Town.
Rowe, A. W., Esq., M.S., M.B., F.G.S., Shottendane, Margate.
Rudler, F. W., Esq., I.S.O., F.G.S., Ethel Villa, Tatsfield, Westerham, Kent.
Rugby School Natural History Society.

St. Andrews, University Library.
St. Helens Central Public Library, The Gamble Institute, St. Helens.
Salfeld, Dr. Hans, Geological Institute of University, Göttingen, Germany.
Salisbury Public Library.
Scarborough Philosophical Society.
Scharff, R. F., Esq., Ph.D., National Museum, Dublin.
Schmidt, Dr. Martin, Büchsenstrasse 56, Stuttgart.
Scott, D. H., Esq., M.A., Ph.D., F.R.S., East Oakley House, Oakley, Hants.
Sheffield Free Public Library.
Sheffield, Literary and Philosophical Society of, Church Street.
Sheffield, University of.
Sheffield, Weston Park Public Museum.
Sheppard, Thomas, Esq., F.G.S., Municipal Museum, Hull.
Sherborne, King's School, Library of.
Shrewsbury Public Library.
Smith, Mrs. Emma, Hencotes House, Hexham.
Smith, Stanley, Esq., B.A., F.G.S., University College, Aberystwyth.
Sollas, Professor W. J., D.Sc., F.R.S., *Local Secretary*, University Museum, Oxford.
Somersetshire Archæological and Natural History Society, Museum, Taunton.
Sophia, University of.
South Shields Public Library.
Southport Public Library.
Southwark, Central Library and Cuming Museum, Walworth Road. S.E.
Spencer, W. K., Esq., M.A., F.G.S., The Gables, Constable Road, Ipswich.
Stebbing, W. P. D., Esq., F.G.S., Frythe Park, Walton-on-the Hill, Epsom.
Stechert, G. E., Esq., 2, Star Yard, Carey Street, Chancery Lane. W.C.
Stepney Borough Reference Library, Bancroft Road, Mile End Road. E.
Stockholm, Royal Swedish Academy of Sciences.
Stoke Newington Public Library, Church Street, Stoke Newington. N.
Stoke-upon-Trent Public Library, Stoke-upon-Trent.
Stonyhurst College, Blackburn.
Storey, Charles B. C., Esq., M.A., F.G.S., Plâs Nantyr, Glyn, Ruabon.
Strahan, A., Esq., M.A., Sc.D., F.R.S., Geological Survey, 28, Jermyn Street. S.W.
Sunderland Corporation Museum.
Sunderland Subscription Library, Fawcett Street, Sunderland.
Swansea Public Library.
Swansea, Royal Institution of South Wales.
Swinnerton, Prof. H. H., D.Sc., University College, Nottingham.

Sydney, New South Wales, University of.
Sydney, New South Wales, Australian Museum.

Tasmania, Royal Society of.
Thornton, H. Gerard, Esq., B.A., Kingsthorpe Hall, Northampton.
Toronto (Canada), University Library.
Torquay Natural History Society, Museum, Babbacombe Road, Torquay.
Toulouse (France), University Library.
Trafford, H. H., Esq., The Bungalow, Croston, near Preston.
Treacher, Llewellyn, Esq., F.G.S., Somercroft, Twyford, Berks.
Truro, Royal Institution of Cornwall.
Tübingen (Germany), University Library.

Upsala (Sweden), University Library.

Vienna, Royal Natural History Court Museum, Geological Department.

Walker, Sir B. E., C.V.O., LL.D., Canadian Bank of Commerce, Toronto, Canada.
Wandsworth Public Library, West Hill, Wandsworth. S.W.
Warren, S. Hazzledine, Esq., F.G.S., Sherwood, Loughton, Essex.
Warrington Public Museum and Library.
Warsaw, University Library.
Warwickshire Natural History and Archæological Society, The Museum, Warwick.
Washington, U.S. Geological Survey.
Watts, Professor W. W., M.A., F.R.S., Imperial College of Science, South Kensington. S.W.
Weg, Max, 3, Königstrasse, Leipzig, Germany.
Wesley and Son, William, 28, Essex Street, Strand. W.C.
West Ham, Essex Museum, Municipal Technical Institute, Romford Road. E.
West Hartlepool Public Library.
Whitby Literary and Philosophical Society, Museum, Whitby.
Wilmore, Albert, Esq., D.Sc., F.G.S., Fernbank, Colne, Lancashire.
Wiltshire Archæological and Natural History Society, Devizes.
Winchester College Natural History Society, Winchester.
Winwood, Rev. Henry H., M.A., F.G.S., *Local Secretary*, 11, Cavendish Crescent, Bath.
Wolverhampton Public Library.
Wood, J. G., Esq., M.A., F.S.A., F.G.S., 7, New Square, Lincoln's Inn. W.C.
Woodhead, J. H., Esq., F.G.S., 3, College Mansions, Winchester Avenue, Brondesbury. N.
Woods, Henry, Esq., M.A., F.G.S., *Local Secretary*, Sedgwick Museum, Cambridge.
Woodward, A. Smith, Esq., LL.D., F.R.S., *Secretary*, British Museum (Nat. Hist.), South Kensington. S.W.
Woodward, Henry, Esq., LL.D., F.R.S., *President*, 13, Arundel Gardens, Notting Hill. W.

Worcester Public Library and Hastings Museum, Worcester.
Wordie, James M., Esq., B.A., F.G.S., St. John's College, Cambridge.
Workington Public Library, Workington, Cumberland.
Würzburg (Germany), University Library.

Yorkshire Philosophical Society, Museum, York.
Young, George W., Esq., F.G.S., 20, Grange Road, Barnes. S.W.
Yule, Miss A. F., Tarradale House, by Muir-of-Ord, Ross-shire. N.B.

CATALOGUE OF THE CONTENTS OF THE ANNUAL VOLUMES

ALREADY PUBLISHED BY

THE PALÆONTOGRAPHICAL SOCIETY.

Vol. I.	Issued March, 1848, for the Year 1847	The Crag Mollusca, Part I, Univalves, by Mr. S. V. Wood (pp. i—xii, 1—208, pls. i—xxi, and title-page).
„ II.	Issued July, 1849, for the year 1848	The Reptilia of the London Clay, Vol. I, Part I, Chelonia, &c., by Profs. Owen and Bell (pp. 1—76, pls. i—xxviii, viii A, x A, xiii A, xvi A, xviii A, xix*, xix B, xix C, xix D). The Eocene Mollusca, Part I, Cephalopoda, by Mr. F. E. Edwards (pp. 1—56, pls. i—ix).
„ III.[1]	Issued Aug., 1850, for the Year 1849	The Entomostraca of the Cretaceous Formations, by Mr. T. R. Jones (pp. 1—40, pls. i—vii). The Permian Fossils, by Prof. Wm. King (pp. i—xxxviii, 1—258, pls. i—xxviii*). The Reptilia of the London Clay, Vol. I, Part II, Crocodilia and Ophidia, &c., by Prof. Owen (pp. 1—68, pls. xxix, i—xvi, ii A). The Fossil Corals, Part I, Crag, London Clay, Cretaceous, by Messrs. Milne Edwards and Jules Haime (pp. i—lxxxv, 1—72, pls. i—xi).
„ IV.	Issued June, 1851, for the Year 1850	The Crag Mollusca, Part II, No. 1, by Mr. S. V. Wood (pp. 1—150, pls. i—xii). The Mollusca of the Great Oolite, Part I, Univalves, by Messrs. Morris and Lycett (pp. i—viii, 1—130, pls. i—xv). The Fossil Brachiopoda, Vol. I, Part III, No. 1, Oolitic and Liassic, by Mr. Davidson (pp. 1—64, pls. i—xiii).
„ V.	Issued June, 1851, for the Year 1851	The Reptilia of the Cretaceous Formations, by Prof. Owen (pp. 1—118, pls. i—xxxvii, vii A, ix A). The Fossil Corals, Part II, Oolitic, by Messrs. Milne Edwards and Jules Haime (pp. 73—146, pls. xii—xxx). The Fossil Lepadidæ, by Mr. Charles Darwin (pp. i—vi, 1—88, pls. i—v).
„ VI.	Issued Aug., 1852, for the Year 1852	The Fossil Corals, Part III, Permian and Mountain-limestone, by Messrs. Milne Edwards and Jules Haime (pp. 147—210, pls. xxxi—xlvi). The Fossil Brachiopoda, Vol. I, Part I, Tertiary, by Mr. Davidson (pp. 1—23, pls. i, ii). The Fossil Brachiopoda, Vol. I, Part II, No. 1, Cretaceous, by Mr. Davidson (pp. 1—54, pls. i—v). The Fossil Brachiopoda, Vol. I, Part III, No. 2, Oolitic, by Mr. Davidson (pp. 65—100, pls. xiv—xviii). The Eocene Mollusca, Part II, Pulmonata, by Mr. F. E. Edwards (pp. 57—122, pls. x—xv). The Echinoderms of the Crag, London Clay, &c., by Prof. E. Forbes (pp. i—viii, 1—36, pls. i—iv, and title-page).
„ VII.	Issued Dec., 1853, for the Year 1853	The Fossil Corals, Part IV, Devonian, by Messrs. Milne Edwards and Jules Haime (pp. 211—244, pls. xlvii—lvi). The Fossil Brachiopoda, Introduction to Vol. I, by Mr. Davidson (pp. 1—136, pls. i—ix). The Mollusca of the Chalk, Part I, Cephalopoda, by Mr. D. Sharpe (pp. 1—26, pls. i—x). The Mollusca of the Great Oolite, Part II, Bivalves, by Messrs. Morris and Lycett (pp. 1—80, pls. i—viii). The Mollusca of the Crag, Part II, No. 2, Bivalves, by Mr. S. V. Wood (pp. 151—216, pls. xiii—xx). The Reptilia of the Wealden Formations, Part I, Chelonia, by Prof. Owen (pp. 1—12, pls. i—ix).

[1] The Volume for the year 1849 consists of two separate portions, each of which is stitched in a paper cover, on which are printed the dates 1848, 1849, and 1850. The one portion contains 'Cretaceous Entomostraca' and 'Permian Fossils'; the other, 'London Clay Reptilia,' Part II, and 'Fossil Corals,' Part I.

CATALOGUE OF VOLUMES—Continued.

Vol. VIII.[1] Issued May, 1855, for the Year 1854	The Fossil Brachiopoda, Vol. I, Part II, No. 2, Cretaceous (pp. 55—117, pls. vi—xii), with Appendix and Index to Vol. I, by Mr. Davidson (pp. 1—30, pl. A). The Reptilia of the Wealden Formations, Part II, Dinosauria, by Prof. Owen (pp. 1—54, pls. i—xix, xvi A). The Mollusca of the Great Oolite, Part III, Bivalves, by Messrs. Morris and Lycett (pp. 81—147, pls. ix—xv). The Fossil Corals, Part V, Silurian, by Messrs. Milne Edwards and Jules Haime (pp. 245—322, pls. lvii—lxxii). The Fossil Balanidæ and Verrucidæ, by Mr. Charles Darwin (pp. 1—44, pls. i, ii). The Mollusca of the Chalk, Part II, Cephalopoda, by Mr. D. Sharpe (pp. 27—36, pls. xi—xvi). The Eocene Mollusca, Part III, No. 1, Prosobranchiata, by Mr. F. E. Edwards (pp. 123—180, pls. xvi—xxiii).
,, IX.[2] Issued Feb., 1857, for the Year 1855	The Mollusca of the Crag, Part II, No. 3, Bivalves, by Mr. S. V. Wood (pp. 217—342, pls. xxi—xxxi). The Reptilia of the Wealden Formations, Part III, by Prof. Owen (pp. 1—26, pls. i—xii). The Eocene Mollusca, Part III, No. 2, Prosobranchiata, continued, by Mr. F. E. Edwards (pp. 181—240, pls. xxiv—xxvii). The Mollusca of the Chalk, Part III, Cephalopoda, by Mr. D. Sharpe (pp. 37—68, pls. xvii—xxvii). The Tertiary Entomostraca, by Mr. T. R. Jones (pp. i—xii, 1—68, pls. i—vi). The Fossil Echinodermata, Oolitic, Vol. I, Part I, by Dr. Wright (pp. v—x, 1—154, pls. i—x).
,, X. Issued April, 1858, for the Year 1856	The Fossil Echinodermata, Oolitic, Vol. I, Part II, by Dr. Wright (pp. 155—302, pls. xi—xxii). The Fossil Crustacea, Part I, London Clay, by Prof. Bell (pp. i—viii, 1—44, pls. i—xi). The Fossil Brachiopoda, Vol. II, Part IV, Permian, by Mr. Davidson (pp. 1—51, pls. i—iv). The Fossil Brachiopoda, Vol. II, Part V, No. 1, Carboniferous, by Mr. Davidson (pp. 1—48, pls. i—viii). The Reptilia of the Wealden Formations, by Prof. Owen, Part IV (pp. 8—26, pls. iv—xi), and Supplement No. 1 (pp. 1—7, pls. i—iii). The Reptilia of the London Clay, Vol. I (Supplement), by Prof. Owen (pp. 77—79, pls. xxviii A, xxviii B).
,, XI. Issued Nov., 1859, for the Year 1857	The Fossil Echinodermata, Oolitic, Vol. I, Part III, by Dr. Wright (pp. 303—390, pls. xxiii—xxxvi). The Fossil Brachiopoda, Vol. II, Part V, No. 2, Carboniferous, by Mr. Davidson (pp. 49—80, pls. ix—xvi). The Reptilia of the Cretaceous Formations (Supplement No. 1), by Prof. Owen (pp. 1—19, pls. i—iv). The Reptilia of the Wealden Formations (Supplement No. 2), by Prof. Owen (pp. 20—44, pls. v—xii.) The Polyzoa of the Crag, by Prof. Busk (pp. i—xiv, 1—136, pls. i—xxii).
,, XII. Issued March, 1861, for the Year 1858	The Fossil Echinodermata, Oolitic, Vol. I, Part IV, by Dr. Wright (pp. 391—468, pls. xxxvii—xliii). The Eocene Mollusca, Part III, No. 3, Prosobranchiata continued, by Mr. F. E. Edwards (pp. 241—330, pls. xxviii—xxxiii). The Reptilia of the Cretaceous Formations (Supplements No. 2, No. 3), by Prof. Owen (pp. 27—30, pl. vii, pp. 1—25, pls. i—vi). The Reptilia of the Purbeck Limestones, by Prof. Owen (pp. 31—39, pl. viii). The Fossil Brachiopoda, Vol. II, Part V, No. 3, Carboniferous by Mr. Davidson (pp. 81—120, pls. xvii—xxvi).
,, XIII. Issued Dec., 1861, for the Year 1859	The Fossil Brachiopoda, Part V, No. 4, Carboniferous, by Mr. Davidson (pp. 121—210, pls. xxvii—xlvii). The Reptilia of the Oolitic Formations, No. 1, Lower Lias, by Prof. Owen (pp. 1—14, pls. i—vi). The Reptilia of the Kimmeridge Clay, No. 1, by Prof. Owen (pp. 15, 16, pl. vii). The Eocene Mollusca, Part IV, No. 1, Bivalves, by Mr. S. V. Wood (pp. 1—74, pls. i—xiii).

[1] This Volume is marked on the outside 1855.
[2] This Volume is marked on the outside 1856.

CATALOGUE OF VOLUMES—Continued.

Vol. XIV. Issued May, 1863, for the Year 1860	The Fossil Brachiopoda, Vol. II, Part V, No. 5, Carboniferous, by Mr. Davidson (pp. 211—280, pls. xlviii—lv). The Reptilia of the Oolitic Formations, No. 2, Lower Lias, by Prof. Owen (pp. 1—26, pls. i—xi). The Reptilia of the Kimmeridge Clay, No. 2, by Prof. Owen (pp. 27, 28, pl. xii). The Fossil Estheriæ, by Prof. Rupert Jones (pp. i—x, 1—134, pls. i—v). The Fossil Crustacea, Part II, Gault and Greensand, by Prof. Bell (pp. i—vii, 1—40, pls. i—xi).
,, XV. Issued May, 1863, for the Year 1861	The Fossil Echinodermata, Oolitic, Vol. II, Part I (Asteroidea), by Dr. Wright (pp. 1—130, pls. i—x, x A, xi, xii). Supplement to the Great Oolite Mollusca, by Dr. Lycett (pp. 1—129, pls. xxxi—xlv).
,, XVI. Issued Aug., 1864, for the Year 1862	The Fossil Echinodermata, Cretaceous, Vol. I, Part I, by Dr. Wright (pp. 1—64, pls. i—iii, iii A, iv—vii, vii A, viii, xi). The Trilobites of the Silurian, Devonian, &c., Formations, Part I (Devonian and Silurian), by Mr. J. W. Salter (pp. 1—80, pls. i—vi). The Fossil Brachiopoda, Vol. III, Part VI, No. 1, Devonian, by Mr. Davidson (pp. 1—56, pls. i—ix). The Eocene Mollusca, Part IV, No. 2, Bivalves, by Mr. S. V. Wood (pp. 75—136, pls. xiv—xx). The Reptilia of the Cretaceous Formations (Supplement, No. 4), by Prof. Owen (pp. 1—18, pls. i—ix). The Reptilia of the Wealden and Purbeck Formations (Supplement, No. 3), by Prof. Owen (pp. 19—21, pl. x).
,, XVII. Issued June, 1865, for the Year 1863	The Trilobites of the Silurian, Devonian, &c., Formations, Part II, by Mr. J. W. Salter (pp. 81—128, pls. vii—xiv). The Fossil Brachiopoda, Vol. III, Part VI, No. 2, Devonian, by Mr. Davidson (pp. 57—131, pls. x—xx). The Belemnitidæ, Part I, Introduction, by Prof. Phillips (pp. 1—28). The Reptilia of the Liassic Formations, Part I, by Prof. Owen (pp. 1—40, pls. i—xvi).
,, XVIII. Issued April, 1866, for the Year 1864	The Fossil Echinodermata, Oolitic, Vol. II, Part II (Liassic Ophiuroidea), by Dr. Wright (pp. 131—154, pls. xiii—xviii). The Trilobites of the Silurian, Devonian, &c., Formations, Part III, by Mr. J. W. Salter (pp. 129—176, pls. xv—xxv). The Belemnitidæ, Part II, Liassic Belemnites, by Prof. Phillips (pp. 29—52, pls. i—vii). The Pleistocene Mammalia, Part I, Introduction, Felis spelæa, by Messrs. W. Boyd Dawkins and W. A. Sanford (pp. i—l, 1—28, pls. i—v). Title-pages, &c., to the Monographs on the Reptilia of the London Clay, Cretaceous, and Wealden Formations.
,, XIX.[1] Issued Dec., 1866, for the Year 1865	The Crag Foraminifera, Part 1, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady (pp. i—vi, 1—72, pls. i—iv). Supplement to the Fossil Corals, Part I, Tertiary, by Dr. Duncan (pp. i—iii, 1—66, pls. i—x). The Fossil Merostomata, Part I, Pterygotus, by Mr. H. Woodward (pp. 1—44, pls. i—ix). The Fossil Brachiopoda, Vol. III, Part VII, No. 1, Silurian, by Mr. Davidson (pp. 1—88, pls. i—xii).
,, XX. Issued June, 1867, for the Year 1866	Supplement to the Fossil Corals, Part IV, No. 1, Liassic, by Dr. Duncan (pp. i—iii, 1—44, pls. i—xi). The Trilobites of the Silurian, Devonian, &c., Formations, Part IV (Silurian), by Mr. J. W. Salter (pp. 177—214, pls. xxv*—xxx). The Fossil Brachiopoda, Vol. III, Part VII, No. 2, Silurian, by Mr. Davidson (pp. 89—168, pls. xiii—xxii). The Belemnitidæ, Part III, Liassic Belemnites, by Prof. Phillips (pp. 53—88, pls. viii—xx).
,, XXI. Issued June, 1868, for the Year 1867	Flora of the Carboniferous Strata, Part I, by Mr. E. W. Binney (pp. 1—32, pls. i—vi). Supplement to the Fossil Corals, Part IV, No. 2, Liassic, by Dr. Duncan (pp. 45—73, pls. xii—xvii). The Fossil Echinodermata, Cretaceous, Vol. I, Part II, by Dr. Wright (pp. 65—112, pls. ix, x, xii—xxi, xxi A, xxi B). The Fishes of the Old Red Sandstone, Part I, by Messrs. J. Powrie and E. Ray Lankester (pp. 1—32, pls. i—v). The Pleistocene Mammalia, Part II, Felis spelæa, continued, by Messrs. W. Boyd Dawkins and W. A. Sanford (pp. 29—124, pls. vi—xix).

[1] From 1865 onwards the Volumes are issued in two forms of binding: first, with all the Monographs stitched together and enclosed in one cover; secondly, with each of the Monographs separate, and the whole of the separate parts placed in an envelope. The previous Volumes are not in separate parts.

CATALOGUE OF VOLUMES—Continued.

Vol. XXII. Issued Feb., 1869, for the Year 1868

- Supplement to the Fossil Corals, Part II, No. 1, Cretaceous, by Dr. Duncan (pp. 1—26, pls. i—ix).
- The Fossil Merostomata, Part II, Pterygotus, by Mr. H. Woodward (pp. 45—70, pls. x—xv).
- The Fossil Brachiopoda, Vol. III, Part VII, No. 3, Silurian, by Mr. Davidson (pp. 169—248, pls. xxiii—xxxvii).
- The Belemnitidæ, Part IV, Liassic and Oolitic Belemnites, by Prof. Phillips (pp. 89—108, pls. xxi—xxvii).
- The Reptilia of the Kimmeridge Clay, No. 3, by Prof. Owen (pp. 1—12, pls. i—iv).
- The Pleistocene Mammalia, Part III, Felis spelæa, concluded, with F. lynx, by Messrs. W. Boyd Dawkins and W. A. Sanford (pp. 125—176, pls. xx—xxii, xxii A, xxii B, xxiii).

„ XXIII. Issued Jan., 1870, for the Year 1869

- Supplement to the Fossil Corals, Part II, No. 2, Cretaceous, by Dr. Duncan (pp. 27—46, pls. x—xv).
- The Fossil Echinodermata, Cretaceous, Vol. I, Part III, by Dr. Wright (pp. 113—136, pls. xxii—xxix, xxix A, xxix B).
- The Belemnitidæ, Part V, Oxford Clay, &c., Belemnites, by Prof. Phillips (pp. 109—128, pls. xxviii—xxxvi).
- The Fishes of the Old Red Sandstone, Part I (concluded), by Messrs. J. Powrie and E. Ray Lankester (pp. 33—62, pls. vi—xiv).
- The Reptilia of the Liassic Formations, Part II, by Prof. Owen (pp. 41—82, pls. xvii—xx).
- The Crag Cetacea, No. 1, by Prof. Owen (pp. 1—40, pls. i—v).

„ XXIV. Issued Jan., 1871, for the Year 1870

- The Flora of the Carboniferous Strata, Part II, by Mr. E. W. Binney (pp. 33—62, pls. vii—xii).
- The Fossil Echinodermata, Cretaceous, Vol. I, Part IV, by Dr. Wright (pp. 137—160, pls. xxx—xxxix).
- The Fossil Brachiopoda, Vol. III, Part VII, No. 4, Silurian, by Mr. Davidson (pp. 249—397, pls. xxxviii—l).
- The Eocene Mollusca, Part IV, No. 3, Bivalves, by Mr. S. V. Wood (pp. 137—182, pls. xxi—xxv).
- The Fossil Mammalia of the Mesozoic Formations, by Prof. Owen (pp. i—vi, 1—115, pls. i—iv).

„ XXV. Issued June, 1872, for the Year 1871

- The Flora of the Carboniferous Strata, Part III, by Mr. E. W. Binney (pp. 63—96, pls. xiii—xviii).
- The Fossil Merostomata, Part III, Pterygotus and Slimonia, by Mr. H. Woodward (pp. 71—120, pls. xvi—xx).
- Supplement to the Crag Mollusca, Part I (Univalves), by Mr. S. V. Wood, with an Introduction on the Crag District, by Messrs. S. V. Wood, jun., and F. W. Harmer (pp. i—xxxi, 1—98, pls. i—vii, and map).
- Supplement to the Reptilia of the Wealden (Iguanodon), No. IV, by Prof. Owen (pp. 1—15, pls. i—iii).
- The Pleistocene Mammalia, Part IV, Felis pardus, &c., by Messrs. W. Boyd Dawkins and W. A. Sanford (pp. 177—194, pls. xxiv, xxv).
- The Pleistocene Mammalia, Part V, Ovibos moschatus, by Mr. W. Boyd Dawkins (pp. 1—30, pls. i—v).

„ XXVI. Issued Oct., 1872, for the Year 1872

- Supplement to the Fossil Corals, Part III (Oolitic), by Prof. Duncan (pp. 1—24, pls. i—vii), with an Index to the Tertiary and Secondary Species.
- The Fossil Echinodermata, Cretaceous, Vol. I, Part V, by Dr. Wright (pp. 161—184, pls. xl—xliv).
- The Fossil Merostomata, Part IV (Stylonurus, Eurypterus, Hemiaspis), by Mr. H. Woodward (pp. 121—180, pls. xxi—xxx).
- The Fossil Trigoniæ, No. I, by Dr. Lycett (pp. 1—52, pls. i—ix).

CATALOGUE OF VOLUMES—Continued.

Vol. XXVII. Issued Feb., 1874, for the Year 1873

- The Fossil Echinodermata, Cretaceous, Vol. I, Part VI, by Dr. Wright (pp. 185—224, pls. xlv—lii).
- Supplement to the Fossil Brachiopoda, Vol. IV, Part I (Tertiary and Cretaceous), by Mr. Davidson (pp. 1—72, pls. i—viii).
- Supplement to the Crag Mollusca, Part II (Bivalves), by Mr. S. V. Wood (pp. 99—231, pls. viii—xi, and add. plate).
- Supplement to the Reptilia of the Wealden (Iguanodon), No. V, by Prof. Owen (pp. 1—18, pls. i, ii).
- Supplement to the Reptilia of the Wealden (Hylæochampsa), No. VI, by Prof. Owen (pp. 1—7).
- The Fossil Reptilia of the Mesozoic Formations, Part I, by Prof. Owen (pp. 1—14, pls. i, ii).

„ XXVIII. Issued July, 1874, for the Year 1874

- The Post-Tertiary Entomostraca, by Mr. G. S. Brady, Rev. H. W. Crosskey, and Mr. D. Robertson (pp. i—v, 1—232, pls. i—xvi).
- The Carboniferous Entomostraca, Part I (Cypridinidæ), by Prof. T. Rupert Jones and Messrs. J. W. Kirkby and G. S. Brady (pp. 1—56, pls. i—v).
- The Fossil Trigoniæ, No. II, by Dr. Lycett (pp. 53—92, pls. x—xix).

„ XXIX. Issued Dec. 1875, for the Year 1875

- The Flora of the Carboniferous Strata, Part IV, by Mr. E. W. Binney (pp. 97—147, pls. xix—xxiv).
- The Fossil Echinodermata, Cretaceous, Vol. I, Part VII, by Dr. Wright (pp. 225—264, pls. liii—lxii).
- The Fossil Trigoniæ, No. III, by Dr. Lycett (pp. 93—148, pls. xx—xxvii).
- The Fossil Reptilia of the Mesozoic Formations, Part II, by Prof. Owen (pp. 15—94, pls. iii—xxii).

„ XXX. Issued Dec., 1876, for the Year 1876

- The Carboniferous and Permian Foraminifera (the genus Fusulina excepted), by Mr. H. B. Brady (pp. 1—166, pls. i—xii).
- Supplement to the Fossil Brachiopoda, Vol. IV, Part II, No. 1 (Jurassic and Triassic), by Mr. Davidson (pp. 73—144, pls. ix—xvi).
- Supplement to the Reptilia of the Wealden (Poikilopleuron and Chondrosteosaurus), No. VII, by Prof. Owen (pp. 1—7, pls. i—vi).

„ XXXI. Issued Feb., 1877, for the Year 1877

- Supplement to the Eocene Mollusca (Bivalves), by Mr. S. V. Wood, 2 plates.
- The Fossil Trigoniæ, No. IV, by Dr. Lycett (pp. 149—204, pls. xxviii—xl).
- The Eocene Mollusca (Univalves), Part IV, by Mr. S. V. Wood (pp. 331—361, pl. xxxiv).
- The Carboniferous Ganoid Fishes, Part I (Palæoniscidæ), by Dr. Traquair (pp. 1—60, pls. i—vii).
- The Fossil Reptilia of the Mesozoic Formations, Part III, by Prof. Owen (pp. 95—97, pls. xxiii, xxiv).
- The Fossil Elephants, Part I (E. antiquus), by Prof. Leith Adams (pp. 1—68, pls. i—v).

„ XXXII. Issued Mar., 1878, for the Year 1878

- The Fossil Echinodermata, Cretaceous, Vol. I, Part VIII, by Dr. Wright (pp. 265—300, pls. lxii A, lxiii—lxix).
- Index and Title Page to the Fossil Echinodermata, Oolitic, Vol. I (Echinoidea), by Dr. Wright (pp. 469—481).
- The Fossil Merostomata, Part V (Neolimulus, &c.), by Dr. H. Woodward (pp. 181—263, pls. xxxi—xxxvi, and title-page).
- Supplement to the Fossil Brachiopoda, Vol. IV, Part II, No. 2 (Jurassic and Triassic), by Mr. Davidson (pp. 145—242, pls. xvii—xxix).
- The Lias Ammonites, Part I, by Dr. Wright (pp. 1—48, pls. i—viii).
- The Sirenoid and Crossopterygian Ganoids, Part I, by Prof. Miall (pp. 1—32, pls. i, i A, ii—v).
- Supplement to the Reptilia of the Wealden (Goniopholis, Petrosuchus, and Suchosaurus), No. VIII, by Prof. Owen (pp. 1—15, pls. i—vi).
- The Pleistocene Mammalia, Part A (Preliminary Treatise), by Prof. Boyd Dawkins (pp. i—xxxviii).

CATALOGUE OF VOLUMES—Continued.

Vol. XXXIII. Issued May, 1879, for the Year 1879

- The Eocene Flora, Vol. I, Part I, by Mr. J. S. Gardner and Baron Ettingshausen (pp. 1—38, pls. i—v).
- Second Supplement to the Crag Mollusca (Univalves and Bivalves), by Mr. S. V. Wood (pp. i, ii, 1—58, pls. i—vi, and title-page).
- The Fossil Trigoniæ, No. V, by Dr. Lycett (pp. 205—245, pl. xli, and title-page).
- The Lias Ammonites, Part II, by Dr. Wright (pp. 49—164, pls. ix—xviii).
- Supplement to the Reptilia of the Wealden (Goniopholis, Brachydectes, Nannosuchus, Theriosuchus, and Nuthetes), No. IX, by Prof. Owen (pp. 1—19, pls. i—iv).
- The Fossil Elephants, Part II (E. primigenius), by Prof. Leith Adams (pp. 69—146, pls. vi—xv).

,, XXXIV. Issued May, 1880, for the year 1880

- The Eocene Flora, Vol. I, Part II, by Mr. J. S. Gardner and Baron Ettingshausen (pp. 39—58, pls. vi—xi).
- The Fossil Echinodermata, Oolitic, Vol. II, Part III (Asteroidea and Ophiuroidea), by Dr. Wright (pp. 155—203, pls. xix—xxi, pp. i—iv, and title-page).
- Supplement to the Fossil Brachiopoda, Vol. IV, Part III (Permian and Carboniferous), by Mr. Davidson (pp. 243—316, pls. xxx—xxxvii).
- The Lias Ammonites, Part III, by Dr. Wright (pp. 165—264, pls. xix—xl).
- The Reptilia of the London Clay, Vol. II, Part I (Chelone), by Prof. Owen (pp. 1—4, pls. i, ii).

,, XXXV. Issued May, 1881, for the Year 1881

- The Fossil Echinodermata, Cretaceous, Vol. I, Part IX, by Dr. Wright (pp. 301—324, pls. lxx—lxxv).
- Supplement to the Fossil Brachiopoda, Vol. IV, Part IV (Devonian and Silurian, from Budleigh-Salterton Pebble Bed), by Mr. Davidson (pp. 317—368, pls. xxxviii—xlii).
- The Fossil Trigoniæ (Supplement No. 1), by Dr. Lycett (pp. 1—4).
- The Lias Ammonites, Part IV, by Dr. Wright (pp. 265—328, pls. xxii A, xxii B, xli—xlviii).
- The Reptilia of the Liassic Formations, Part III, by Prof. Owen (pp. 83—134, pls. xxi—xxxiii, and title-page).
- The Fossil Elephants, Part III (E. primigenius and E. meridionalis), by Prof. Leith Adams (pp. 147—265, pls. xvi—xxviii, and title-page).

,, XXXVI. Issued June, 1882, for the Year 1882

- The Eocene Flora, Vol. I, Part III, by Mr. J. S. Gardner and Baron Ettingshausen (pp. 59—86, pls. xii, xiii, and title-page).
- Third Supplement to the Crag Mollusca, by the late Mr. S. V. Wood (pp. 1—24, pl. i).
- The Fossil Echinodermata, Cret., Vol. I, Part X, by Dr. Wright (pp. 325—371, pls. lxxvi—lxxx, and title-page).
- Supplement to the Fossil Brachiopoda, Vol. IV, Part V, by Dr. Davidson (pp. 369—383, and title-page).
- Do., Vol. V, Part I (Devonian and Silurian), by Dr. Davidson (pp. 1—134, pls. i—vii).
- The Lias Ammonites, Part V, by Dr. Wright (pp. 329—400, pls. xlix—lii, lii A, liii—lxix).

,, XXXVII. Issued Oct., 1883, for the Year 1883

- The Eocene Flora, Vol. II, Part I, by Mr. J. S. Gardner (pp. 1—60, pls. i—ix).
- The Trilobites of the Silurian, Devonian, &c., Formations, Part V, by the late Mr. J. W. Salter (pp. 215—224, and title-page).
- The Carboniferous Trilobites, Part I, by Dr. H. Woodward (pp. 1—38, pls. i—vi).
- Supplement to the Fossil Brachiopoda, Vol. V, Part II (Silurian), by Dr. Davidson (pp. 135—242, pls. viii—xvii).
- The Fossil Trigoniæ (Supplement No. 2), by the late Dr. Lycett (pp. 5—19, pls. i—iv, and title-page).
- The Lias Ammonites, Part VI, by Dr. Wright (pp. 401—440, pls. lxx—lxxvii).

,, XXXVIII. Issued Dec., 1884, for the Year 1884

- The Eocene Flora, Vol. II, Part II, by Mr. J. S. Gardner (pp. 61—90, pls. x—xx).
- The Carboniferous Entomostraca, Part I, No. 2, by Prof. T. Rupert Jones, Mr. J. W. Kirkby, and Prof. G. S. Brady (pp. i—iii, 57—92, pls. vi, vii, and title-page).
- The Carboniferous Trilobites, Part II, by Dr. H. Woodward (pp. 39—86, pls. vii—x, and title-page).
- Supplement to the Fossil Brachiopoda, Vol. V, Part III, by Dr. Davidson (pp. 243—476, pls. xviii—xxi, and title-page).
- The Lias Ammonites, Part VII, by Dr. Wright (pp. 441—480, pls. lxxviii—lxxxvii).

CATALOGUE OF VOLUMES—Continued.

Vol. XXXIX. Issued Jan., 1886, for the Year 1885	The Eocene Flora, Vol. II, Part III, by Mr. J. S. Gardner (pp. 91—159, pls. xxi—xxvii, and title-page). The Stromatoporoids, Part I, by Prof. Alleyne Nicholson (pp. i—iii, 1—130, pls. i—xi). The Fossil Brachiopoda (Bibliography), Vol. VI (pp. 1—163), by the late Dr. Davidson and Mr. W. H. Dalton. The Lias Ammonites, Part VIII, by the late Dr. Wright (pp. 481—503, pl. lxxxviii, and title-page).
,, XL. Issued Mar., 1887, for the Year 1886	The Morphology and Histology of Stigmaria Ficoides, by Prof. W. C. Williamson (pp. i—iv, 1—62, pls. i—xv). The Fossil Sponges, Part I, by Dr. G. J. Hinde (pp. 1—92, pls. i—viii). The Jurassic Gasteropoda, Part I, No. 1, by Mr. W. H. Hudleston (pp. 1—56). The Inferior Oolite Ammonites, Part I, by Mr. S. S. Buckman (pp. 1—24, pls. i—vi). The Pleistocene Mammalia, Part VI, by Prof. Boyd Dawkins (pp. 1—29, pls. i—vii).
,, XLI. Issued Jan., 1888, for the Year 1887	The Fossil Sponges, Part II, by Dr. G. J. Hinde (pp. 93—188, pl. ix). The Palæozoic Phyllopoda, Part I, by Prof. T. R. Jones and Dr. Woodward (pp. 1—72, pls. i—xii). The Jurassic Gasteropoda, Part I, No. 2, by Mr. W. H. Hudleston (pp. 57—136, pls. i—vi). The Inferior Oolite Ammonites, Part II, by Mr. S. S. Buckman (pp. 25—56, pls. vii—xiv).
,, XLII. Issued Mar., 1889, for the Year 1888	The Stromatoporoids, Part II, by Prof. Alleyne Nicholson (pp. 131—158, pls. xii—xix). The Tertiary Entomostraca (Supplement), by Prof. T. Rupert Jones and Mr. C. D. Sherborn (pp. 1—55, pls. i—iii). The Jurassic Gasteropoda, Part I, No. 3, by Mr. W. H. Hudleston (pp. 137—192, pls. vii—xi). The Inferior Oolite Ammonites, Part III, by Mr. S. S. Buckman (pp. 57—144, pls. xv, xxiii A). The Devonian Fauna of the South of England, Part I, by the Rev. G. F. Whidborne (pp. i, ii, 1—46, pls. i—iv). Title-pages and Prefaces to the Monographs on the Reptilia of the Wealden and Purbeck (Supplements), Kimmeridge Clay, and Mesozoic Formations, and on the Cetacea of the Red Crag.
,, XLIII. Issued Mar., 1890, for the Year 1889	The Cretaceous Entomostraca (Supplement), by Prof. T. Rupert Jones and Dr. G. J. Hinde (pp. i—viii, 1—70, pls. i—iv). The Jurassic Gasteropoda, Part I, No. 4, by Mr. W. H. Hudleston (pp. 193—224, pls. xii—xvi). The Inferior Oolite Ammonites, Part IV, by Mr. S. S. Buckman (pp. 145—224, pls. xxiv—xxxvi). The Devonian Fauna of the South of England, Part II, by the Rev. G. F. Whidborne (pp. 47—154, pls. v—viii, viii A, ix—xv).
,, XLIV. Issued Apr., 1891, for the Year 1890	The Stromatoporoids, Part III, by Prof. Alleyne Nicholson (pp. 159—202, pls. xx—xxv). The Fossil Echinodermata, Cretaceous, Vol. II, Part I (Asteroidea), by Mr. W. Percy Sladen (pp. 1—28, pls. i—viii). The Inferior Oolite Ammonites, Part V, by Mr. S. S. Buckman (pp. 225—256, pls. xxxvii—xliv). The Devonian Fauna of the South of England, Part III, by the Rev. G. F. Whidborne (pp. 155—250, pls. xvi—xxiv). Title-pages to the Supplement to the Fossil Corals, by Prof. Duncan.
,, XLV. Issued Feb., 1892, for the Year 1891	The Jurassic Gasteropoda, Part I, No. 5, by Mr. W. H. Hudleston (pp. 225—272, pls. xvii—xx). The Inferior Oolite Ammonites, Part VI, by Mr. S. S. Buckman (pp. 257—312, pls. xlv—lvii). The Devonian Fauna of the South of England, Part IV (*Conclusion of* Vol. I) (pp. 251—344, pls. xxv—xxxi, and title-page). ,, ,, Vol. II, Part I, by the Rev. G. F. Whidborne (pp. 1—56, pls. i—v).

CATALOGUE OF VOLUMES—Continued.

Vol. XLVI.	Issued Nov., 1892, for the Year 1892	The Stromatoporoids, Part IV (*Conclusion*), by Prof. Alleyne Nicholson (pp. 203—234, pls. xxvi—xxix, and title-page). The Palæozoic Phyllopoda, Part II, by Prof. T. R. Jones and Dr. Woodward (pp. 73—124, pls. xiii—xvii). The Jurassic Gasteropoda, Part I, No. 6, by Mr. W. H. Hudleston (pp. 273—324, pls. xxi—xxvi). The Inferior Oolite Ammonites, Part VII, by Mr. S. S. Buckman (pp. 313—344, pls. lvii—lxxvi). The Devonian Fauna of the South of England, Vol. II, Part II, by the Rev. G. F. Whidborne (pp. 57—88, pls. vi—x).
,, XLVII.	Issued Dec., 1893, for the Year 1893	The Fossil Sponges, Part III, by Dr. G. J. Hinde (pp. 189—254, pls. x—xix). The Fossil Echinodermata, Cretaceous, Vol. II, Part II (Asteroidea), by Mr. W. Percy Sladen (pp. 29—66, pls. ix—xvi). The Inferior Oolite Ammonites, Part VIII, by Mr. S. S. Buckman (pp. 345—376, pls. lxxvii—xcii). The Devonian Fauna of the South of England, Vol. II, Part III, by the Rev. G. F. Whidborne (pp. 89—160, pls. xi—xvii).
,, XLVIII.	Issued Nov., 1894, for the Year 1894	The Jurassic Gasteropoda, Part I, No. 7, by Mr. W. H. Hudleston (pp. 325—390, pls. xxvii—xxxii). Carbonicola, Anthracomya, and Naiadites, Part I, by Dr. W. Hind (pp. 1—80, pls. i—xi). The Inferior Oolite Ammonites, Part IX, by Mr. S. S. Buckman (pp. 377—456, pls. xciii—ciii). The Fishes of the Old Red Sandstone, Part II, No. 1, by Dr. R. H. Traquair (pp. 63—90, pls. xv—xviii).
,, XLIX.	Issued Oct., 1895, for the Year 1895	The Crag Foraminifera, Part II, by Prof. T. R. Jones (pp. 73—210, pls. v—vii). The Jurassic Gasteropoda, Part I, No. 8, by Mr. W. H. Hudleston (pp. 391—444, pls. xxxiii—xl). Carbonicola, Anthracomya, and Naiadites, Part II, by Dr. W. Hind (pp. 81—170, pls. xii—xx). The Devonian Fauna of the South of England, Vol. II, Part IV, by the Rev. G. F. Whidborne (pp. 161—212, pls. xviii—xxiv).
,, L.	Issued Oct., 1896, for the Year 1896	The Crag Foraminifera, Part III, by Prof. T. R. Jones (pp. 211—314). The Jurassic Gasteropoda, Part I, No. 9, by Mr. W. H. Hudleston (pp. 445—514, pls. xli—xliv, and title-page). Carbonicola, Anthracomya, and Naiadites, Part III, by Dr. W. Hind (pp. 171—182, pl. xxi, and title-page). The Carboniferous Lamellibranchiata, Part I, by Dr. W. Hind (pp. 1—80, pls. i, ii). The Devonian Fauna of the South of England, Vol. III, Part I, by the Rev. G. F. Whidborne (pp. 1—112, pls. i—xvi).
,, LI.	Issued Dec., 1897, for the Year 1897	The Crag Foraminifera, Part IV, by Prof. T. R. Jones (pp. vii—xv, 315—402, and title-page). The Carboniferous Lamellibranchiata, Part II, by Dr. W. Hind (pp. 81—208, pls. iii—xv). The Carboniferous Cephalopoda of Ireland, Part I, by Dr. A. H. Foord (pp. 1—22, pls. i—vii). The Devonian Fauna of the South of England, Vol. III, Part II, by the Rev. G. F. Whidborne (pp. 113—178, pls. xvii—xxi).
,, LII.	Issued Dec., 1898, for the Year 1898	The Palæozoic Phyllopoda, Part III, by Prof. T. R. Jones and Dr. Woodward (pp. 125—176, pls. xviii—xxv). The Carboniferous Lamellibranchiata, Part III, by Dr. W. Hind (pp. 209—276, pls. xvi—xxv). The Inferior Oolite Ammonites, Part X, by Mr. S. S. Buckman (pp. i—xxxii, Suppl. pls. i—iv). The Carboniferous Cephalopoda of Ireland, Part II, by Dr. A. H. Foord (pp. 23—48, pls. viii—xvii). The Devonian Fauna of the South of England, Vol. III, Part III, by the Rev. G. F. Whidborne (pp. 179—236, pls. xxii—xxxviii).

CATALOGUE OF VOLUMES—Continued.

Vol. LIII.	Issued Dec., 1899, for the Year 1899	The Palæozoic Phyllopoda, Part IV, by Prof. T. R. Jones and Dr. Woodward (pp. i—xv, 175, 176, 177—211, pls. xxvi—xxxi, and title-page). The Cretaceous Lamellibranchia, Part I, by Mr. H. Woods (pp. 1—72, pls. i—xiv). The Carboniferous Lamellibranchiata, Part IV, by Dr. W. Hind (pp. 277—360, pls. xxvi—xxxix). The Inferior Oolite Ammonites, Part XI, by Mr. S. S. Buckman (pp. xxxiii—lxiv, pls. v—xiv).
„ LIV.	Issued Dec., 1900, for the Year 1900	The Cretaceous Lamellibranchia, Part II, by Mr. H. Woods (pp. 73—112, pls. xv—xix). The Carboniferous Lamellibranchiata, Part V, by Dr. W. Hind (pp. 361—476, pls. xl—liv). The Carboniferous Cephalopoda of Ireland, Part III, by Dr. A. H. Foord (pp. 49—126, pls. xviii—xxxii). The British Pleistocene Mammalia, Title-page for Vol. I, by Messrs. Dawkins and Sanford. The Structure of Carboniferous Plants, Title-page, by Mr. E. W. Binney.
„ LV.	Issued Dec., 1901, for the Year 1901	The Cretaceous Lamellibranchia, Part III, by Mr. H. Woods (pp. 113—144, pls. xx—xxvi). The Carboniferous Lamellibranchiata, Vol. II, Part I, by Dr. W. Hind (pp. 1—34, pls. i—vi), Title-page and Index for Vol. I. The Carboniferous Cephalopoda of Ireland, Part IV, by Dr. A. H. Foord (pp. 127—146, pls. xxxiii—xxxix). British Graptolites, Part I, by Miss Elles and Miss Wood, edited by Prof. Lapworth (pp. 1—54, pls. i—iv). Ganoid Fishes of British Carboniferous Formations—Part I, Palæoniscidæ, No. 2, by Dr. Ramsay H. Traquair (pp. 61—87, pls. viii—xviii).
„ LVI.	Issued Dec., 1902, for the Year 1902	The Cave Hyæna, by Prof. S. H. Reynolds (pp. 1—25, pls. i—xiv). The Fishes of the English Chalk, Part I, by Dr. A. Smith Woodward (pp. 1—56, pls. i—xiii). The Cretaceous Lamellibranchia, Part IV, by Mr. H. Woods (pp. 145—196, pls. xxvii—xxxviii). British Graptolites, Part I, No. 2,, by Miss Elles and Miss Wood, edited by Prof. Lapworth (pp. i—xxviii, 55—94, pls. v—xiii).
„ LVII.	Issued Dec., 1903, for the Year 1903	The Fishes of the English Chalk, Part II, by Dr. A. Smith Woodward (pp. 57—96, pls. xiv—xx). The Cretaceous Lamellibranchia, Part V, by Mr. H. Woods (pp. i—xliii, 197—232, pls. xxxix—xlii), Title-page and Index for Vol. I. The Carboniferous Lamellibranchiata, Vol. II, Part II, by Dr. W. Hind (pp. 35—124, pls. vii—xxi). The Carboniferous Cephalopoda of Ireland, Part V, by Dr. A. H. Foord (pp. 147—234, pls. xl—xlix), Title-page and Index. The Lower Palæozoic Trilobites of Girvan, Part I, by Mr. F. R. Cowper Reed (pp. 1—48, pls. i—vi). British Graptolites, Part III, by Miss Elles and Miss Wood, edited by Prof. Lapworth (pp. xxix—lii, 103—134, pls. xiv—xix).
.. LVIII.	Issued Dec., 1904, for the Year 1904	The Fishes of the Old Red Sandstone, Part II, No. 2, by Dr. R. H. Traquair (pp. 91—118, pls. xix—xxvi). The Cretaceous Lamellibranchia, Vol. II, Part I, by Mr. H. Woods (pp. 1—56, pls. i—vii). The Carboniferous Lamellibranchiata, Vol. II, Part III, by Dr. W. Hind (pp. 125—216, pls. xxii—xxv). The Inferior Oolite Ammonites, Part XII, by Mr. S. S. Buckman (pp. lxv—clxviii, pls. xv—xix). The Lower Palæozoic Trilobites of Girvan, Part II, by Mr. F. R. Cowper Reed (pp. 49—96, pls. vii—xiii). British Graptolites, Part IV, by Miss Elles and Miss Wood, edited by Prof. Lapworth (pp. liii—lxxii, 135—180, pls. xx—xxv).

CATALOGUE OF VOLUMES—Continued.

Vol. LIX. Issued Nov., 1905, for the Year 1905

- The Fossil Echinodermata, Cretaceous, Vol. II, Part III, by Mr. W. K. Spencer (pp. 67—90, pls. xvii—xxvi).
- The Cretaceous Lamellibranchia, Vol. II, Part II, by Mr. H. Woods (pp. 57—96, pls. viii—xi).
- The Carboniferous Lamellibranchiata, Vol. II, Title-pages and Index, by Dr. W. Hind.
- The Inferior Oolite Ammonites, Part XIII, by Mr. S. S. Buckman (pp. clxix—ccviii, pls. xx—xxiv).
- The Cornbrash Fauna, Part I, by the Rev. J. F. Blake (pp. 1—100, pls. i—ix).

„ LX. Issued Dec., 1906, for the Year 1906

- The Pleistocene Bears, by Prof. S. H. Reynolds (pp. 1—35, pls. i—viii).
- The Fishes of the Old Red Sandstone, Part II, No. 3, by Dr. R. H. Traquair (pp. 119—130, pls. xxvii—xxxi).
- The Cretaceous Lamellibranchia, Vol. II, Part III, by Mr. H. Woods (pp. 97—132, pls. xii—xix).
- The Lower Palæozoic Trilobites of Girvan, Part III, by Mr. F. R. Cowper Reed (pp. 97—186, Title-page and Index, pls. xiv—xx).
- The Cambrian Trilobites, Part I, by Mr. P. Lake (pp. 1—28, pls. i, ii).
- British Graptolites, Part V, by Miss Elles and Miss Wood, edited by Prof. Lapworth (pp. lxxiii—xcvi, 181—216, pls. xxvi, xxvii).

„ LXI. Issued Dec., 1907, for the Year 1907

- The Sirenoid Ganoids, Part II, by Prof. L. C. Miall (pp. 33—34, Title-page, Preface, and Postscript).
- Ganoid Fishes of British Carboniferous Formations, Part I, Palæoniscidæ, No. 3, by Dr. R. H. Traquair (pp. 87—106, pls. xix—xxiii).
- The Fishes of the English Chalk, Part III, by Dr. A. Smith Woodward (pp. 97—128, pls. xxi—xxvi).
- The Inferior Oolite Ammonites, Part XIV, by Mr. S. S. Buckman (pp. ccix—cclxii, Title-pages, Preface, and Index).
- The Cretaceous Lamellibranchia, Vol. II, Part IV, by Mr. H. Woods (pp. 133—180, pls. xx—xxvii).
- The Fossil Echinodermata, Cretaceous, Vol. II, Part IV, by Mr. W. K. Spencer (pp. 91—132, pls. xxvii—xxix).
- The British Conulariæ, by Miss Ida L. Slater (pp. 1—40, pls. i—v, Title-page and Index).
- The Cambrian Trilobites, Part II, by Mr. P. Lake (pp. 29—48, pls. iii, iv).
- British Graptolites, Part VI, by Miss Elles and Miss Wood (Mrs. Shakespear), edited by Prof. Lapworth (pp. xcvii—cxx, 217—272, pls. xxviii—xxxi).
- The Devonian Fauna of the South of England, Vol. II, Part V, and Vol. III, Part IV, by the Rev. G. F. Whidborne (Vol. II, pp. 215—222, Title-page and Index; Vol. III, pp. 237—247, Title-page and Index).
- The Cornbrash Fauna, Part II, by the Rev. J. F. Blake (pp. 101—102, Title-page and Index).

„ LXII. Issued Dec., 1908, for the Year 1908

- The Fishes of the English Chalk, Part IV, by Dr. A. Smith Woodward (pp. 129—152, pls. xxvii—xxxii).
- Illustrations of Type Specimens of Inferior Oolite Ammonites (pls. i—vii).
- The Cretaceous Lamellibranchia, Vol. II, Part V, by Mr. H. Woods (pp. 181—216, pls. xxviii—xxxiv).
- The Fossil Echinodermata, Cretaceous, Vol. II, Part V, by Mr. W. K. Spencer (pp. 133—138, Title-page and Index).
- The Cambrian Trilobites, Part III, by Mr. P. Lake (pp. 49—64, pls. v, vi.)
- British Graptolites, Part VII, by Miss Elles and Miss Wood (Mrs. Shakespear), edited by Prof. Lapworth (pp. cxxi—cxlviii, 273—358, pl. xxxii—xxxv).

„ LXIII. Issued Dec., 1909, for the Year 1909

- The Pleistocene Canidæ, by Prof. S. H. Reynolds (pp. 1—28, pls. i—vi).
- Ganoid Fishes of British Carboniferous Formations, Part I, Palæoniscidæ, No. 4, by Dr. R. H. Traquair (pp. 107—122, pls. xxiv—xxx).
- The Fishes of the English Chalk, Part V, by Dr. A. Smith Woodward (pp. 153—184, pls. xxxiii—xxxviii).
- The Cretaceous Lamellibranchia, Vol. II, Part VI, by Mr. H. Woods (pp. 217—260, pls. xxxv—xliv).
- The Mollusca of the Chalk, Part I, Cephalopoda, by Mr. D. Sharpe (Title-page and Index).
- The Belemnitidæ, by Prof. Phillips (Title-page and Index).

CATALOGUE OF VOLUMES—Continued.

Vol. LXIV.	Issued Jan., 1911, for the Year 1910	Ganoid Fishes of British Carboniferous Formations, Part I, Palæoniscidæ, No. 5, by Dr. R. H. Traquair (pp. 123—158, pls. xxxi—xxxv). The Fishes of the English Chalk, Part VI, by Dr. A. Smith Woodward (pp. 185—224, pls. xxxix—xlvi). The Cretaceous Lamellibranchia, Vol. II, Part VII, by Mr. H. Woods (pp. 261—284, pls. xlv—l). The Carboniferous Arachnida, by Mr. R. I. Pocock (pp. 1—84, pls. i—iii). British Graptolites, Part VIII, by Miss Elles and Miss Wood (Mrs. Shakespear), edited by Prof. Lapworth (pp. 359—414, pls. xxxvi—xli).
,, LXV.	Issued Feb., 1912, for the Year 1911	The Pleistocene Mustelidæ, by Prof. S. H. Reynolds (pp. 1—28, pls. i—viii). Ganoid Fishes of British Carboniferous Formations, Part I, Palæoniscidæ, No. 6, by Dr. R. H. Traquair (pp. 159—180, pls. xxxvi—xl). The Fishes of the English Chalk, Part VII, by Dr. A. Smith Woodward (pp. i—viii, 225—264, pls. xlvii—liv, including Title-page and Index). The Cretaceous Lamellibranchia, Vol. II, Part VIII, by Mr. H. Woods (pp. 285—340, pls. li—liv). The Fossil Sponges, Title-page and Index to Vol. I, by Dr. G. J. Hinde (pp. 255—264).
,, LXVI.	Issued Feb., 1913, for the Year 1912	British Graptolites, Part IX, by Miss Elles and Miss Wood (Mrs. Shakespear), edited by Prof. Lapworth (pp. 415—486, pls. xlii—xlix). The Cambrian Trilobites, Part IV, by Mr. P. Lake (pp. 65—88, pls. vii—x). The Cretaceous Lamellibranchia, Vol. II, Part IX, by Mr. H. Woods (pp. 341—473, pls. lv—lxii, including Title-page and Index). The Fossil Malacostracous Crustacea, by Prof. T. Bell (Title-page and Index).
,, LXVII.	Issued Feb., 1914, for the Year 1913	British Graptolites, Part X, by Miss Elles and Miss Wood (Mrs. Shakespear), edited by Prof. Lapworth (pp. 487—526, pls. l—lii). The Palæozoic Asterozoa, Part I, by Mr. W. K. Spencer (pp. 1—56, pl. i). The Lower Palæozoic Trilobites of Girvan.—Supplement, by Dr. F. R. Cowper Reed (pp. 1—56, pls. i—viii, including Title-page and Index). The Pliocene Mollusca, Part I, by Mr. F. W. Harmer (pp. 1—200, pls. i—xxiv). Ganoid Fishes of British Carboniferous Formations, Part I, Palæoniscidæ, No. 7, by Dr. R. H. Traquair (pp. i—vi, 181—186, including Title-page and Index). The Fishes of the Old Red Sandstone, Part II, No. 4, by Dr. R. H. Traquair (pp. 131—134, including Title-page and Index).
,, LXVIII.	Issued July, 1915, for the Year 1914	The Pliocene Mollusca, Part II, by Mr. F. W. Harmer (pp. 201—302, pls. xxv—xxxii).

CATALOGUE OF THE COMPLETED VOLUMES OF MONOGRAPHS

PUBLISHED BY

THE PALÆONTOGRAPHICAL SOCIETY.

Adams (A. L.) Monograph on the British Fossil Elephants. 1877—81. 3 parts, 28 plates. £1 5*s*.

Bell (T.) A Monograph of the Fossil Malacostracous Crustacea of Great Britain. 1857—62. 2 parts, 22 plates. 15*s*.

——— *See* Owen.

Binney (E. W.) Observations on the Structure of Fossil Plants found in the Carboniferous Strata. 1867—75. 4 parts, 24 plates. £1 1*s*.

Blake (J. F.) A Monograph of the Fauna of the Cornbrash. 1905—7. 2 parts, 9 plates. 10*s*.

Brady (H. B.) A Monograph of Carboniferous and Permian Foraminifera (the genus Fusulina excepted). 1876. 12 plates. 12*s*.

——— *See* Jones, Parker, etc.

Brady, Crosskey, and Robertson. A Monograph of the Post-Tertiary Entomostraca of Scotland, including species from England and Ireland. 1874. 16 plates. 16*s*.

Buckman (S. S.) A Monograph on the Inferior Oolite Ammonites of the British Islands. 1887—1907. 14 parts, 128 plates. £5 15*s*.

——— [and Secretary]. Illustrations of Type Specimens of Inferior Oolite Ammonites in the Sowerby Collection. 1908. 7 plates. 7*s*.

Burrows (H. W.) *See* Jones, Parker, etc.

Busk (G.) A Monograph of the Fossil Polyzoa of the Crag. 1859. 22 plates. 15*s*.

Chapman (F.) *See* Jones, Parker, etc.

Crosskey (H. W.) *See* G. S. Brady.

Darwin (C.) A Monograph of the Fossil Cirripedes of Great Britain (Lepadidæ, Balanidæ, Verrucidæ). 1851—4. 2 parts, 7 plates. 10*s*.

Davidson (T.) British Fossil Brachiopoda. 1851—86. 6 vols., 234 plates. £10 10*s*.

Dawkins and Sanford. The British Pleistocene Mammalia. 1866—9. Vol. I. 3 parts, 25 plates. £1 1*s*.

——— *See* S. H. Reynolds.

Duncan (P. M.) A Monograph of the British Fossil Corals. Second Series, being a Supplement to the Monograph of the British Corals by Milne-Edwards and Haime. 1866—91. 7 parts, 49 plates. £2 2*s*.

Edwards (F. E.) A Monograph of the Eocene Mollusca, or Descriptions of Shells from the older Tertiaries. 1849—77. Part I, out of print. Part II, Pulmonata, 7 plates, 5*s*. Part III, Prosobranchiata, 18 plates, 12*s*. Part IV, Pulmonata and Prosobranchiata, 1 plate, 3*s*. 6*d*.

Ettingshausen (C.) *See* J. S. Gardner.

Foord (A. H.) Monograph on the Carboniferous Cephalopoda of Ireland. 1897—1903. 5 parts, 49 plates. £2 5*s*.

Forbes (E.) Monograph of the Echinodermata of the British Tertiaries. 1852. 4 plates. 3*s*.

Gardner and Ettingshausen. A Monograph of the British Eocene Flora. 1879—86. 2 vols, 40 plates. £1 16*s*.

Haime (J.) *See* Milne-Edwards.

Hind (Wheelton). A Monograph of the British Carboniferous Lamellibranchiata. 1896—1905. 2 vols., 79 plates. £3 16*s*.

——— A Monograph on Carbonicola, Anthracomya, and Naiadites. 1894—6. 3 parts, 21 plates. £1 1*s*.

Hinde (G. J.) A Monograph of the British Fossil Sponges. 1887—1912. 4 parts, 19 plates. £1.

——— *See* T. R. Jones.

Holland (R.) *See* Jones, Parker, etc.

Hudleston (W. H.) A Monograph of the British Jurassic Gasteropoda. Part I, Gasteropoda of the Inferior Oolite. 1887—96. 9 parts, 44 plates. £2 2*s*.

Jones (T. R.) Monograph of the Entomostraca of the Cretaceous Formation of England. 1849. 7 plates. Out of print.

——— A Monograph of the Fossil Estheriæ. 1862. 5 plates. 6*s*.

Jones and Hinde. A Supplementary Monograph of the Cretaceous Entomostraca of England and Ireland. 1890. 4 plates. 5*s*.

Jones, Kirkby, and Brady. A Monograph of the British Fossil Bivalved Entomostraca from the Carboniferous Formations. 1874—84. Part I (complete). 7 plates. 7*s*. 6*d*.

Jones, Parker, Brady, Burrows, Sherborn, Millett, Holland, and Chapman. A Monograph of the Foraminifera of the Crag. 1866—97. 4 parts, 7 plates. £1 5*s*.

Jones and Sherborn. A Monograph of the Tertiary Entomostraca of England. 1857—89. 2 parts, 9 plates. 10*s*.

Jones and Woodward. A Monograph of the British Palæozoic Phyllopoda. 1887—99. 4 parts, 31 plates. £1 10*s*.

King (W.) Monograph of the Permian Fossils of England. 1850. 29 plates. Out of print.

Kirkby (J. W.) *See* T. R. Jones.

Lankester (E. R.) *See* Powrie.

Lycett (J.) Supplementary Monograph on the Mollusca from the Stonesfield Slate, Great Oolite, Forest Marble, and Cornbrash. 1863. 15 plates. 12*s*.

——— A Monograph of the British Fossil Trigoniæ. 1872—83. 7 parts, 45 plates. £2 2*s*.

——— *See* J. Morris.

Miall (L. C.) Monograph on the Sirenoid and Crossopterygian Ganoids. 1878—1907. 2 parts, 6 plates. 6*s*.

Millett (F. W.) *See* Jones, Parker, etc.

Milne-Edwards and Haime. A Monograph of the British Corals. 1850—5. Part I. 11 plates. Out of print. Part II. Oolitic. 19 plates. 10*s*. Part III. Permian and Mountain Limestone. 16 plates. 10*s*. Part IV. Devonian. 10 plates. 6*s*. Part V. Silurian. 16 plates. 10*s*.

——— *See* P. M. Duncan.

Morris and Lycett. A Monograph of the Mollusca from the Great Oolite, chiefly from Minchinhampton and the Coast of Yorkshire. 1851—63. 4 parts, 45 plates. £2 2*s*.

Nicholson (H. A.) A Monograph of the British Stromatoporoids. 1886—92. 4 parts, 29 plates. £1 10*s*.

Owen (R.) Monograph of the British Fossil Cetacea from the Red Crag. 1870—89. 5 plates. 5*s*.

——— Monograph of the Fossil Mammalia of the Mesozoic Formations. 1871. 4 plates. 5*s*.

——— A Monograph on the Fossil Reptilia of the Cretaceous Formations. 1851—64. 59 plates. £2 2*s*.

——— A Monograph of the Fossil Reptilia of the Liassic Formations. 1861—81. 5 parts, 50 plates. £1 10*s*.

——— Monograph on the Fossil Reptilia of the Mesozoic Formations. 1874—7. 3 parts, 24 plates. £1.

——— Monograph of the Fossil Reptilia of the Wealden and Purbeck Formations. 1853—89. With 9 Supplements and 83 plates. £3.

——— Monograph on the Reptilia of the Kimmeridge Clay and Portland Stone. 1859—89. 6 plates. 5*s*.

Owen and Bell. Monograph on the Fossil Reptilia of the London Clay. Vol. I. 1849—59. 58 plates. Out of print.

——— ——— Vol. II. Part I. 1880. 2 plates. 2*s*. 6*d*.

Parker (W. K.) *See* Jones, Parker, etc.

Phillips (J.) A Monograph of British Belemnitidæ. 1865—70. 5 parts, 36 plates. £1 10*s*.

Powrie, Lankester, and Traquair. A Monograph of the Fishes of the Old Red Sandstone of Britain. 1867—1914. 2 vols. in 7 parts, 49 plates. £2 5*s*.

Reed (F. R. C.) The Lower Palæozoic Trilobites of the Girvan District, Ayrshire. 1903—6. 3 parts, 20 plates. £1.

——— Supplement to above. 1914. 8 plates. 8*s*.

Reynolds (S. H.) A Monograph of the British Pleistocene Mammalia. Vol. II. 1902—9. 3 parts, 28 plates. £1 8*s*.

Robertson (D.) *See* G. S. Brady.

Salter (J. W.) A Monograph of British Trilobites. 1864—83. 5 parts, 21 plates. £1 5*s*.

Sanford (W. A.) *See* W. B. Dawkins.

Sharpe (D.) Description of the Fossil Remains of Mollusca found in the Chalk of England. 1853—6. 3 parts, 27 plates. £1 1*s*.

Sherborn (C. D.) *See* T. R. Jones.

——— *See* Jones, Parker, etc.

Sladen (W. P.) *See* T. Wright.

Slater (I. L.) A Monograph of British Conulariæ. 1907. 5 plates. 5*s*.

Spencer (W. K.) *See* T. Wright.

Traquair (R. H.) The Ganoid Fishes of the British Carboniferous Formations. Part I. Palæoniscidæ. 1877—1914. 7 parts, 40 plates. £1.

——— *See* Powrie.

Whidborne (G. F.) A Monograph of the Devonian Fauna of the South of England. Vols. I and II. Fauna of the Limestones of Lummaton, Wolborough, Chircombe Bridge, and Chudleigh. 1889—95. 8 parts, 56 plates. £2 10*s*.

——— Devonian Fauna. Vol. III. The Fauna of the Marwood and Pilton Beds of North Devon and Somerset. 1896—1907. 4 parts, 38 plates. £1 10*s*.

Williamson (W. C.) A Monograph of the Morphology and History of Stigmaria Ficoides. 1887. 15 plates. 12*s*.

Wood (S. V.) A Monograph of the Crag Mollusca or Descriptions of Shells from the Middle and Upper Tertiaries of the East of England. 1848—82. 2 vols. with 3 Supplements, 71 plates. £3 3*s*.

——— A Monograph of the Eocene Bivalves of England. 1861—77. Vol. I with Supplement (all published). 27 plates. £1 1*s*.

Woods (H.) A Monograph of the Cretaceous Lamellibranchia of England. 1899—1913. 2 vols., 104 plates. £5.

Woodward (A. S.) The Fossil Fishes of the English Chalk. 1902—12. 7 parts, 54 plates. £2 10*s*.

Woodward (H.) A Monograph of the British Carboniferous Trilobites. 1883—4. 2 parts, 10 plates. 10*s*.

Woodward (H.) A Monograph of the British Fossil Crustacea belonging to the Order Merostomata. 1866—78. 5 parts, 36 plates. £1 10*s*.

Wright (T.) A Monograph on the British Fossil Echinodermata of the Oolitic Formations. 1857—80. 2 vols., 65 plates. £2 10*s*.

——— Monograph on the Lias Ammonites of the British Islands. 1876—86. 8 parts, 91 plates. £3 3*s*.

——— Sladen (W. P.), and Spencer (W. K.) A Monograph on the British Fossil Echinodermata from the Cretaceous Formations. 1864—1908. 2 vols, 116 plates. £5 10*s*.

The Monographs are on sale by Messrs. Dulau & Co., Ltd., 37, Soho Square, London, W., at the prices affixed. Separate parts are charged at the rate of one shilling per plate. Discount is allowed to members of the Palæontographical Society who order the volumes or parts through the Secretary.

Enquiries concerning the volumes and parts marked out of print may be addressed to Messrs. Dulau & Co., Ltd.

Palæontographical Society, 1914.

THE PLIOCENE MOLLUSCA OF GREAT BRITAIN,

BEING SUPPLEMENTARY TO

S. V. WOOD'S MONOGRAPH OF THE CRAG MOLLUSCA.

BY

F. W. HARMER, F.G.S., F.R.Met.S.,

MEMBRE HONORAIRE DE LA SOCIÉTÉ BELGE DE GÉOLOGIE ET DE PALÉONTOLOGIE.

PART II.

Pages 201—302; Plates XXV—XXXII.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

July, 1915.

PRINTED BY ADLARD AND SON, LONDON AND DORKING

Trophon truncatus, var. **Harmeri**, A. Bell. Plate XXV, fig. 13.

1915. *Trophon Harmeri*, A. Bell, Geol. Mag. [6], vol. ii, p. 167.

Varietal Characters.—Differs from the type in size and in having three distinct but inconspicuous spiral ridges on the lower whorls.

Dimensions.—L. 12 mm. B. 6 mm.

Distribution.—Not known living.

Fossil : Cranstal Point, Isle of Man.

Remarks.—The little shell figured under this name was found by Mr. Bell among some fossils from the Manx drift sent to him by the Rev. S. N. Harrison. It belongs to the *T. truncatus* group, but differs in its transverse sculpture. It is intermediate in size between the type form of that species as given by Jeffreys and specimens from the March Gravels figured by Wood as *T. Bamffius* (Mon. Crag Moll., 1st Suppl., pl. iii, fig. 11). None of the latter in my collection are spirally ornamented, though Forbes and Hanley state that in *T. clathratus* a few obsolete revolving ridges may occasionally be traced. The present variety approaches the shell referred by me in the first part of this Memoir (p. 131, Pl. XII, fig. 28), but I now think in error, to *Trophon Fabricii*. It has been already described by Mr. Bell in a paper submitted to the Isle of Man Natural History Society which has not yet appeared in print.

(?) Sipho hirsutus (Jeffreys). Plate XXV, fig. 10.

1883. *Fusus hirsutus*, Jeffreys, Proc. Zool. Soc. London, p. 396, pl. xliv, fig. 7.

1887. *Neptunea* (*Sipho*) *hirsuta*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. i, p. 88, pl. xvi, figs. 2, 3.

1912. *Sipho hirsutus*, Dautzenberg et Fischer, Camp. Scient. Pr. Monaco, vol. xxxvii (Mollusques), p. 90, pl. iii, figs. 10, 11.

Specific Characters.—Shell turreted, fairly solid; whorls 6—8, tumid, gradually diminishing upwards, the last two-thirds the total length, excavated below; in the recent state opaque and dull, chalky white under the epidermis; ornamented by numerous fine spiral ridges, about fifty on the body-whorl, with minute closely-set striæ in the lines of growth; epidermis in the recent shell rough and hispid, thickly clothed with short bristly hairs on the spiral ridges; apex blunt; suture deep, channelled; mouth pyriform, inflected above; canal fairly wide and open, turning sharply to the left; outer lip thin, curved; inner lip forming a delicate film on the pillar; pillar flexuous.

Dimensions.—L. 45—50 mm. B. 20—22 mm.

Distribution.—*Recent :* Faroes to Spitzbergen.

Fossil : Butleyan Crag : Butley (?).

Remarks.—The shell here figured as *S. hirsutus* was obtained by Mr. Bell some years ago at Butley. It belongs to the *togatus* group, but differs both in form and sculpture from the specimens represented in Pl. XXII of the present Memoir under the latter name. One of these (fig. 2) I received from Christiania as typical of that species, and with this the Waldringfield fossil (fig. 1) closely agrees. Other specimens on the same plate (figs. 3, 4, and 6), called by Mr. Friele *S. curtus*, but identified by him with *S. togatus*, are more or less similar.

The sculpture of the Butley shell is different, resembling more nearly that of *S. hirsutus* as given by Jeffreys and by MM. Dautzenberg and Fischer. On the other hand, a Recent specimen of *S. togatus* from Stockholm (Pl. XXV, fig. 11), which shows the fine clathrated ornamentation of the epidermis in that species together with the characteristic chitinous spines at the points where the spiral ridges intersect the lines of growth, approaches it more nearly in form. I have figured an enlarged representation of this feature (fig. 12), which only shows on the epidermis, magnified 6 diameters.

I fear that in the absence of the epidermis the identification of our fossil with *S. hirsutus* cannot be regarded as altogether satisfactory, but I give it provisionally, and with some doubt, under that name.

PLEUROTOMIDÆ.

Since Wood's monograph of the Crag Mollusca was written many forms then known as *Pleurotoma* have been separated from it and grouped under other generic names; it seems necessary, therefore, to revise his nomenclature in order to bring it more into harmony with that generally adopted at present. Much has been published, moreover, during recent years which makes the correct identification of our Crag Pleurotomidæ with the various type forms more easy than formerly. Many species, unknown to Wood, have been obtained from the Crag beds, especially from the prolific pit at Little Oakley, which prove to be closely allied, if not identical, with those from the Miocene or Pliocene deposits of other regions, or with the Recent Mollusca of the Mediterranean. I have therefore continued where necessary, and as a guide to collectors, the method before adopted of figuring for comparison with the Crag fossils, often waterworn or imperfect, some verified and perfect specimens received from various foreign correspondents. A certain number of Wood's identifications may need reconsideration in the light of our present knowledge, while some of his figures, though the best that could be obtained at the time, are not equal in the delineation of the minute details of form and sculpture which separate one species from another, to

those which can now be produced by photography. For such reasons it seems desirable to deal rather fully with the present family, bringing together, side by side on the same plate, the various forms, often closely allied, of the different genera into which it has been divided which are represented in our Crag deposits.

These are mainly of a more recent type than the large species characteristic of the Miocene and the Lower Pliocene of Italy (Piacenziano), as, for example, those now grouped under the generic names *Clavatula*, *Surcula*, and in part of *Pleurotoma*. Such forms are better represented in the Miocene of the North Sea basin, and, as far as the evidence goes, in the Lenham beds, where we find *Clavatula Jouanneti* and *Surcula consobrina*. The more representative Pleurotomidæ of the East Anglian Crag are smaller shells, like *Bela*, *Raphitoma*, *Mangilia*, *Clathurella*, and *Drillia*, pointing to a closer relation of our deposits, from the Coralline horizon upwards, with the Upper Pliocene of Italy and Sicily (Astiano), and with the Pleistocene deposits of Sicily, Calabria, and Tuscany.[1] The large number of such forms reported here for the first time from the Crag and mostly from one section, leads me to the belief that our lists of fossils may be largely extended by continued and careful investigation in other localities, but few of which have been thoroughly explored.

I fear, however, that, so far as the present group of Mollusca is concerned, few of the earlier lists can be wholly relied on.

Genus **PLEUROTOMA**, Lamarck, 1799.

Pleurotoma turricula (Brocchi). Plate XXVI, figs. 1, 2.

1814. *Murex turricula*, Brocchi, Conch. foss. Subap., vol. ii, p. 435, pl. ix, fig. 20.
1843. *Pleurotoma turricula*, Nyst, Coq. foss. Terr. Tert. Belg., p. 520, pl. xli, fig. 5.
1848. *Pleurotoma turricula*, S. V. Wood, Mon. Crag Moll., pt. i, p. 53, pl. vi, fig. 1 *b*.
1853. *Pleurotoma turricula*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 350, pl. xxxviii, fig. 1.
1853. *Pleurotoma turrifera*, Nyst, in O. d'Halloy, Abrégé de Géol., p. 588.
1872. *Pleurotoma turrifera*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 33.
1875. *Pleurotoma turricula*, Seguenza, Boll. R. Com. Geol. Ital., vol. vi, p. 204, no. 137.
1877. *Pleurotoma turricula*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 39, pl. i, fig. 25.
1879. *Pleurotoma turricula*, Fontannes, Moll. Plioc. Vall. du Rhone, vol. i, p. 41, pl. iv, fig. 6.
1881. *Pleurotoma turricula*, Nyst, Conch. Terr. Tert. Belg., p. 42.
1890. *Pleurotoma turricula*, E. Vincent, Bull. Soc. Malac. Belg., vol. xxv, p. 97 (fig.).
1896. *Pleurotoma turricula*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 128.
1907. *Pleurotoma turricula*, Ravn, Kgl. Danske Vid. Selsk. Skrift. [7], vol. iii, p. 248.

Specific Characters.—Shell slender, elongato-fusiform; whorls nearly flat, ornamented by three strong and rather distant spiral ridges, sometimes granulate,

[1] With the Sicilian deposits which I regard as Pleistocene, Seguenza grouped others at Livorno, Reggio, and elsewhere.

the centre one slightly the most prominent, with very fine lines between them; mouth oblong, acutely angulate above; labial sinus deep; canal long, narrow, nearly straight.

Dimensions.—L. 38—45 mm. B. 12—14 mm.

Distribution.—Not known living.

Fossil: Lenham Beds. Coralline Crag: Boyton, Gedgrave. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Sutton, Waldringfield, Newbourn. Butleyan: Butley, Bawdsey.

Belgium: Diestien, zone à *Isocardia cor* (Casterlien), Scaldisien, Poederlien.

Upper and Middle Miocene: Denmark, Vienna basin. Lower Pliocene: Italy, Rhone Valley. Upper Pliocene: Italy—Bologna, Livorno; France—Biot; Sicily—Altavilla.

Remarks.—The use of the generic name *Pleurotoma* is now restricted to a fusiform group of shells, having an elongate spire, a narrow but deep sinus more or less distant from the suture, and a long, narrow and straight canal.

In his Monograph of 1848, pt. i, p. 53, Wood described the present species under Brocchi's name of *P. turricula*, but in 1872, in his 1st Supplement, he adopted Nyst's suggestion to call it *P. turrifera*, as Montagu had used the former in 1803 for a well-known British shell. In 1881, however, the latter having been referred to the genus *Bela*, Nyst reverted to Brocchi's original name, in which, I think, Crag geologists may now follow him. Strictly our shell should still be called *P. turrifera*, although it has been known throughout Europe for a hundred years under the specific term of *turricula*. Foreign geologists have taken no notice of the former name, and it would cause much and needless confusion to ask them to do so now. After so long a period such unused names may be safely regarded as obsolete.

Two distinct but closely allied varieties of this species occur at Oakley and elsewhere in the Anglo-Belgian Crag, the more common of the two corresponding with the typical *P. turricula* of the Italian Pliocene. It is a slender shell, with a long, narrow and straight canal, and may generally be distinguished from that next to be described, although specimens of an intermediate character are sometimes met with. Most of these fossils are worn in the English Crag, and they are never very abundant; the view has therefore obtained that they are derivative in the latter. In the Poederlien of Antwerp, however, they are fairly numerous and beautifully perfect, having a very recent appearance, sometimes retaining the colour of the spiral bands by which they are ornamented; they are generally smaller and more delicate than the English shells. Wood's fig. 1 *b* probably represents the type form.

Specimens of *P. turricula* from the Miocene of the Vienna basin and of Denmark, figured respectively by Hörnes and Dr. Ravn, have the central ridge granulate; in those from the Italian Pliocene such granulation, where present, is faint and con-

fined to the upper whorls. In the Belgian and East Anglian fossils it is generally wanting.

Var. **antwerpiensis**, E. Vincent. Plate XXVI, figs. 3, 4.

1848. *Pleurotoma turricula*, S. V. Wood, Mon. Crag Moll., pt. i, p. 53, pl. vi, fig. 1 *a*.
1881. *Pleurotoma turricula*, Nyst, Conch. Terr. Tert. Belg., p. 42, pl. iii, fig. 6.
1890. *Pleurotoma antverpiensis*, E. Vincent, Bull. Soc. Malac. Belg., vol. xxv, p. 95 (fig.).
1892. *Pleurotoma antwerpiensis*, Van den Broeck, Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 121, 132.
1912. *Pleurotoma antwerpiensis*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 86, no. 219.

Dimensions.—L. 45 mm. B. 14 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Beaumont, Little Oakley. Newbournian: Waldringfield; probably elsewhere in the Red Crag.

Belgium: Sables à *Isocardia cor*, Scaldisien, Poederlien (Van den Broeck).

Remarks.—In 1890 Vincent described a shell under the name *P. antverpiensis* which he considered specifically distinct from *P. turricula*, differing from it in form, especially in the comparative length and breadth of the body-whorl and the canal. After the examination of three or four hundred examples, he tells us, he came to the conclusion that the true *P. turricula* did not exist in the Belgian Crag, and in this view he was followed by M. van den Broeck; M. van de Wouver, however, has recently found, during the progress of some excavations at the Antwerp docks, a large number of specimens, and some of these, as we have seen, cannot be separated from the typical Italian shell. I have found at Oakley and elsewhere, however, a few fossils, two of them being here figured, agreeing with that given by Vincent as *P. antverpiensis*. They are strong, coarsely sculptured shells which differ only in form from those described above; I prefer to regard them as a variety of Brocchi's species.

P. turricula has been reported from time to time from various localities in the Red Crag; probably both varieties are represented in it, but, so far as I know, the type form is the more common.

There is a specimen in the Jermyn Street Museum labelled *P. contigua*, Brocchi (= *P. turricula*, var. *A*, Bellardi). That form resembles the present variety of *P. turricula* in form, but the sculpture is granulate. The shell in question, however, is too much worn for a satisfactory identification; it would be safer, I think, to omit the name of *P. contigua* from our Crag lists, as indeed Mr. C. Reid has done in his 'Pliocene Deposits of Britain.' Drs. de Stefani and Pantanelli, like Bellardi, regard the latter as a variety of *P. turricula*.[1]

[1] Bull. Soc. Malac. Ital., vol. iv, p. 120, 1878.

Pleurotoma Selysii, De Koninck. Plate XXVI, figs. 17, 18.

1837. *Pleurotoma Selysii*, De Koninck, Coq. foss. Basele, p. 25, pl. i, fig. 4.
1843. *Pleurotoma Selysii*, Nyst, Coq. foss. Terr. Tert. Belg., p. 515, pl. xl, figs. 11, 12.
1861. *Pleurotoma Selysii*, F. E. Edwards, Mon. Moll. Eoc. Form. Engl., pt. i (Palæont. Soc.), p. 278, pl. xxix, fig. 17.
1867. *Pleurotoma Selysii*, Speyer, Palaeontographica, vol. xvi, p. 189, pl. xx, figs. 1—5.
1907. *Pleurotoma Selysi*, Ravn, K. Danske Vid. Selsk. Skrift. [7], vol. iii, p. 344, pl. vii, figs. 9—13.
1913. *Pleurotoma Selysi*, Harder, Danm. Geol. undersøgelse [2], vol. xxii, p. 89, pl. viii, figs. 1—24.

Specific Characters.—Shell slender, fusiform, turreted; spire acuminate; whorls slightly convex below, excavated above, obscurely angulate; ornamented by exceedingly fine and close-set spiral lines, somewhat stronger toward the base of the shell, by a raised band with pliciform tubercles above the suture, and by fine flexuous lines of growth, the last whorl being contracted and produced into a long, straight and narrow canal; mouth ovato-elongate; the labial sinus, situated on the shoulder, is wide and triangular.

Dimensions.—L. 35—70 mm. B. 10—20 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley (derivative). Oligocene: Holland, Belgium, Denmark, North Germany. Eocene: North London.

Remarks.—The Crag specimen here figured is from Oakley, where it is no doubt derivative. Although worn, it retains sufficient of its original sculpture to be identified, in Mr. van der Gracht's opinion, with an Oligocene species, a specimen of which, from one of the Dutch borings under his charge at Siepe, near Winterswyk, he has been kind enough to send to me for comparison.

P. Selysii was reported by F. E. Edwards from the Eocene deposits of Hampstead, Finchley and elsewhere, but our fossil resembles more nearly the Oligocene and Dutch variety of this species than the latter.

Among the specimens of the Pleurotomidæ from Oakley that I regard as derivative, there are a few others which, though clearly different from anything hitherto reported from the Crag, are too imperfect for satisfactory reference. Some of these M. van der Gracht thinks may belong to species from the Oligocene or Miocene of northern Europe. It is to those deposits of the North Sea basin that we may look, perhaps, with most prospect of success for the identification of such derivative fossils.

It is clear that a number of characteristic Miocene species were still living in the Anglo-Belgian basin in Waltonian times, but it seems improbable that any Oligocene forms like the present shell could have survived until that period.

Nyst and De Koninck have reported *P. Selysii* from the Oligocene of Belgium, Speyer from that of North Germany, and, more lately, Drs. Ravn and Harder

from that of Denmark. Judging from the figures of *P. Selysii* published by the latter, twenty-four in all, it seems that this species was, in Oligocene times, a very variable one.

Pleurotoma inermis, Partsch. Plate XXVI, figs. 5, 6.

1842. *Pleurotoma inermis,* Partsch, Neue Aufst. Petr. Samml. K. K. Hof. Min. Cab., no. 960.
1848. *Pleurotoma porrecta,* S. V. Wood, Mon. Crag Moll., pt. i, p. 55, pl. vii, fig. 1.
1853. *Pleurotoma inermis,* Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 349, pl. xxxviii, fig. 10.
1872. *Pleurotoma inermis,* and var. *nuda,* S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 33, pl. iii, figs. 2 *a*, 2 *b*.
1896. *Pleurotoma inermis,* Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 128.
1904. *Pleurotoma inermis,* Sacco, Moll. Terr. Terz. Piem., pt. xxx, p. 42, pl. 11, fig. 47.
1912. *Pleurotoma inermis,* Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. 4, p. 88, no. 226.

Specific Characters.—Shell slender, elongato-fusiform; whorls 9—10, distinctly carinate, convex below and concave above the keel, the last more than half the total length; ornamented in the type by about twelve flexuous longitudinal costæ which are continuous but are sharply reflexed across the shelf and become slightly nodular upon the keel, also by fine impressed striæ which extend to the base of the shell; spire regularly tapering; apex acute; suture well-marked; mouth lanceolate, passing into a long and somewhat twisted canal; columella tortuous.

Dimensions.—L. 28 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gomer, Gedgrave, Ramsholt, Boyton. Waltonian: Walton-on-Naze, Little Oakley.

Miocene: Belgium, Vienna basin, Italy. Diestien (zone à *Terebratula grandis*); Casterlien (zone à *Isocardia cor*): Antwerp. Scaldisien: Holland.

Remarks.—This characteristic Miocene fossil is one of the many species which were unknown to Wood from any Crag horizon later than the Coralline Crag, but has been obtained since from Walton by Prof. Kendal and from Oakley by myself. Dr. Tesch has also found it from one of the Dutch borings in beds believed by him to be equivalent to the Scaldisien of Belgium. Wood figures two varieties, one with the zig-zag sculpture characteristic of the type form of this species (Pl. XXVI, fig. 5), and another he calls var. *nuda* (fig. 6), from which such ornamentation is absent. I figure a well-preserved specimen of each of these from the Coralline Crag of the Boyton marshes.

In his list of Coralline Crag fossils published in Prestwich's paper (Quart. Journ. Geol. Soc., vol. xxvii, 1871, p. 145) Jeffreys identifies the present species with *Pleurotoma nivale,* Lovén, a Recent form ranging from the Portuguese coast to the Arctic circle. Although the sculpture of the latter resembles our shell to

some extent, the mouth and outer lip are different; it is now referred to the genus *Typhlomangilia* of M. Sars. I doubt, as Wood did, whether the Miocene fossil and the Recent shell are the same.

Sub-genus **HEMIPLEUROTOMA**, Cossmann, 1889.

Pleurotoma (Hemipleurotoma) denticulata (Basterot). Plate XXVI, figs. 7, 8.

1825. *Pleurotoma denticula*, Basterot, Descript. Coq. foss. Bordeaux, p. 63, pl. iii, fig. 12.
1832. *Pleurotoma denticula*, Grateloup, Tab. Coq. Dax, p. 320.
1843. *Pleurotoma denticula*, Nyst, Coq. foss. Terr. Tert. Belg., p. 526, pl. xliv, fig. 2.
1847. *Pleurotoma denticula*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 576, pl. iii, fig. 7.
1877. *Pleurotoma denticula*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 27, pl. i, fig. 17.
1886. *Pleurotoma denticulata*, Dollfus et Dautzenberg, Et. prél. Coq. foss. Touraine, p. 9.
1896. *Hemipleurotoma denticula*, Cossmann, Ess. Paléoconch. comp., vol. ii, p. 78, pl. v, figs. 9, 10.

Specific Characters.—Shell elongato-fusiform, turreted; whorls 8, carinated the upper part concave, finely striated; the last rather more than half the total length, excavated below, the base spirally ridged; ornamented by a single row of prominent tubercles on the keel; apex blunt; suture deep and channelled; mouth oval, angulated by the keel, with an angulated notch above; canal rather short and narrow, turning slightly to the left.

Dimensions.—L. 15—25 mm. B. 6—10 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave. Waltonian: Little Oakley. Miocene: Belgium, France, Italy.

Remarks.—Hemipleurotoma, of which the Miocene *P. denticula* of Basterot is taken as the type, has been proposed by M. Cossmann as a sub-genus for a group of Pleurotomas with a short and nearly straight canal. I have obtained one perfect specimen and a few recognizable fragments of the present species from Oakley, and there is another, immature, from the Coralline Crag, in the Sedgwick Museum, Cambridge. They correspond with a shell I brought some years ago from the Miocene deposits of Saubriguez near Dax in south-western France, which I have figured with my Oakley fossil to show their close resemblance. The latter has no appearance of being derivative. I regard it as another of the characteristic Miocene species which lingered on in the Anglo-Belgian basin until the earliest part of the Red Crag period.

The present form is not unlike a shell from the North German Miocene described by Prof. von Koenen as *P. Hosiusi*, of which he has kindly sent me a specimen, but it differs from the latter in size and in its coarser sculpture.

Pleurotoma (Hemipleurotoma) plebeia (Sowerby). Plate XXVI, figs. 9, 10.

1850. *Pleurotoma plebeia*, Sowerby, in Dixon's Geol. Sussex, p. 184, pl. vi, fig. 23.
1856. *Pleurotoma plebeia*, Forbes, Tert. Fluv-mar. Form., Isle of Wight (Mem. Geol. Survey), p. 154, pl. v, fig. 1.
1861. *Pleurotoma denticula*, F. E. Edwards, Mon. Moll. Eoc. Form. Engl. (Palæont. Soc.), p. 286, pl. xxx, fig. 7.
1891. *Pleurotoma* (*Hemipleurotoma*) *plebeia*, Harris and Burrows, Eoc. Olig. Paris Basin (Geol. Assoc.), p. 98.
1896. *Pleurotoma* (*Hemipleurotoma*) *plebeia*, Cossmann, Ess. Paléoconch. comp., vol. ii, p. 78.

Specific Characters.—Shell small, turreted, elongato-conical, sub-cylindrical; whorls 7 or 8, the upper ones finely striated, with a rather prominent tuberculate keel, slightly concave above it, decussated by the lines of growth, the lower part of the body-whorl excavated and ornamented by strong spiral ridges; suture well-marked, channelled, with a thickened line on both sides of it; apex obtuse; mouth oval, angulate above; canal narrow, short, nearly straight.

Dimensions.—L. 13—25 mm. B. 5—7 mm. (Of Crag specimens)—L. 9 mm. B. 3—5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley (derivative). British Eocene: London Clay, Barton and Bracklesham beds. Paris basin; Middle and Upper Eocene.

Remarks.—The smaller of the two specimens figured under the present name (Pl. XXVI, fig. 9) was found at Oakley. In general appearance and colour it differs essentially from the Crag shells, agreeing with one in my collection from the Barton beds of Hampshire, and is, no doubt, an Eocene derivative.

It was referred by Edwards in 1861 (*op. cit.*) to *P. denticula*, a characteristic and abundant shell of the Miocene of Bordeaux, described above, but this is generally considered to have been a mistake, recent writers reverting to the name *P. plebeia*, originally proposed for it by Sowerby. The latter is an Eocene form, the former, as just stated, a Miocene species.

Pleurotoma (Hemipleurotoma) Gastaldii (Bellardi). Plate XXVI, fig. 19.

1847. *Pleurotoma Gastaldii*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 572, pl. ii, fig. 8.
1877. *Pleurotoma Gastaldii*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 50, pl. ii, fig. 8.

Specific Characters.—Shell subfusiform; spire elongate; apex acute; whorls nearly flat, generally without ornament, the last half the total length; suture slight; mouth ovate, ending in a short, straight and narrow canal.

Dimensions (of Crag specimens).—L. 9—12 mm. B. 3—5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Felixstowe. Miocene: Italy.

Remarks.—I have found a specimen at Oakley which seems to correspond with *P. Gastaldii*, Bellardi, although it is considerably smaller than those figured by him from the Italian deposits, but it may probably be immature; it presents, however, the characteristic features of this species, to which I refer it provisionally. Bellardi says that sometimes the surface of the shell is covered with minute spiral striæ, but that more frequently it is nearly smooth. The Oakley specimen shows no sign of sculpture. There is another and imperfect specimen of what is clearly the same shell in the Castle Museum at Norwich, labelled, in Wood's writing, "*P. Gastaldii*, Felixstow."

Genus **CLAVATULA**, Lamarck, 1799.

Clavatula interrupta (Brocchi). Plate XXVI, fig. 20.

1814. *Murex interruptus*, Brocchi, Conch. foss. Subap., vol. ii, p. 433, pl. ix, fig. 21.
1847. *Pleurotoma interrupta*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 559, pl. i, fig. 16.
1856. *Pleurotoma interrupta*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 340, pl. xxxvi, fig. 19.
1872. *Pleurotoma interrupta*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 32, pl. v, fig. 1.
1872. *Pleurotoma interrupta*, von Koenen, Mioc. Nord-Deutsch. Moll. Faun., vol. i, p. 97, no. 109.
1874. *Pleurotoma interrupta*, Van den Broeck, Ann. Soc. Malac. Belg., vol. ix, p. 125.
1875. *Pleurotoma interrupta*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 206, no. 152.
1877. *Clavatula interrupta*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 169, pl. v, fig. 33.
1914. *Clavatula interrupta*, Cipolla, Palaeont. Ital., vol. xx, p. 126, pl. xii, fig. 16.

Specific Characters.—Shell large, solid, fusiform; spire long, gradually and regularly tapering to a fine point; whorls about 10, ornamented by a raised subnodular marginal band beneath the suture, a channelled depression without spiral sculpture under it, and by a prominent series of granulated ridges which form a rounded projection or keel from the centre of the whorls to the suture next below, the ridges extending on the body-whorl to the base of the shell; mouth oval, angulate above; labial sinus well-marked, with a small triangular notch next the suture; canal fairly long, narrow; columella nearly straight; outer lip rounded, not expanded, slightly angulated by the keel; inner lip forming a rather thick glaze on the pillar.

Dimensions.—L. 45—55 mm. B. 15—18 mm. (Of Crag specimen)—L. 25 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Newbournian Crag: Waldringfield.

Miocene: Belgium, North Germany, Vienna basin. Lower Pliocene: Italy. Upper Pliocene: Italy—Bologna, Livorna; Sicily—Altavilla.

Remarks.—This species is now grouped with the genus *Clavatula* of Lamarck, distinguished by a long spire, and a rather short canal, the outer lip having a marginal notch below its junction with the body-whorl.

An imperfect specimen from the Newbournian Crag of Waldringfield was referred by Wood to this species, which is very common, according to M. van den Broeck, in the Miocene (Bolderien) of Belgium (zone à *Panopæa Menardi*) and is characteristic of the Pliocene deposits of Italy.

It is the only representative of the present genus hitherto recorded from the East Anglian Crag, but it is probably derivative in our deposits.

Genus **GENOTIA (GENOTA),** H. and A. Adams, 1853.

Genotia ramosa (Basterot). Plate XXVI, figs. 21, 22.

1825. *Pleurotoma ramosa*, Basterot, Descript. Coq. foss. Bordeaux, p. 63, pl. iii, fig. 15
1843. *Pleurotoma ramosa*, Nyst, Coq. foss. Terr. Tert. Belg., p. 524.
1847. *Pleurotoma ramosa*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 550, pl. i, fig. 7.
1856. *Pleurotoma ramosa*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 335, pl. xxxvi, figs. 10—14.
1872. *Pleurotoma ramosa*, von Koenen, Mioc. Nord-Deutsch. Moll. Faun., pt. i, p. 96, no. 107.
1877. *Genota ramosa*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 64, pl. iii, figs. 2, 3.
1886. *Genota ramosa*, Dollfus et Dautzenberg, Et. prél. Coq. foss. Touraine, p. 9.
1887. *Genotia ramosa*, P. Fischer, Man. Conch., p. 589.

Specific Characters.—Shell subfusiform, elongate, turreted; spire tapering to an acute point; whorls noduloso-carinate, keel situated not far below the suture; the nodules pass downwards into inconspicuous longitudinal ribs along the lines of growth, two of the latter becoming confluent on each nodule; covered by fine and closely-set spiral striæ which cross the ribs; body-whorl two-thirds and mouth one-half the total length; mouth long and narrow, angulated above by the keel of the last whorl, which is continuous with a straight and open canal.

Dimensions.—L. 25—70 mm. B. 8—28 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Miocene: Belgium (Nyst), North Germany (von Koenen), Touraine, Vienna basin, Italy.

Remarks.—The genus *Genotia*, originally *Genota*, and formerly included with *Pleurotoma*, was proposed by H. and A. Adams for a distinct group of shells, conical or mitræform in shape, with a body-whorl diminishing regularly in size to the base of the shell, and a long, narrow mouth continuous with the canal.

I have obtained a single specimen at Oakley, which, though imperfect and probably immature, was identified without hesitation by M. Dollfus as *Genotia ramosa*. It shows the characteristic form and nodular carinæ of that species. With my Oakley fossil I figure also a perfect example from the Miocene of Touraine. This form has not been recorded hitherto from any Pliocene deposit; it may be regarded, I think, as extraneous to the proper fauna of the Crag.

Genus **PSEUDOTOMA**, Bellardi, 1875.

Pseudotoma intorta (Brocchi). Plate XXVI, figs. 11—14.

1814. *Murex intortus*, Brocchi, Conch. foss. Subap., vol. ii, p. 427, pl. viii, fig. 17.
1837. *Pleurotoma Morreni*, De Koninck, Coq. foss. Basele, p. 21, pl. i, fig. 3.
1843. *Pleurotoma intorta*, Nyst, Coq. foss. Terr. Tert. Belg., p. 509, pl. xli, fig. 2; *P. Morreni*, p. 510, pl. xl, fig. 6.
1847. *Pleurotoma intorta*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 544, pl. i, fig. 13.
1848. *Pleurotoma intorta*, S. V. Wood, Mon. Crag Moll., pt. i, p. 53, pl. vi, fig. 4.
1874. *Pleurotoma intorta*, Van den Broeck, Ann. Soc. Malac. Belg., vol. ix, p. 125.
1875. *Pleurotoma intorta*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 208, no. 177.
1877. *Pseudotoma intorta*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 214, pl. vii, fig. 10.
1881. *Pleurotoma intorta*, Nyst, Conch. Terr. Tert. Belg., p. 47, pl. iii, fig. 11.
1887. *Pleurotoma intorta*, Ravn, Kongl. Dansk. Vid. Selsk. Skrift. [7], vol. ii, p. 343.
1896. *Pleurotoma intorta*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 128.
1912. *Pleurotoma intorta*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 88, no. 220.

Specific Characters.—Shell thick and strong, elongate, turreted, subfusiform; whorls carinated, convex below, deeply excavated above, the last about two-thirds the total length; apex acute; suture deep, well defined; ornamented by coarse oblique costæ, nodulous on the keel, gradually dying out downwards, and by conspicuous lines of growth; mouth long, narrow, continuous to the base, without any distinct canal; outer lip angulated by the keel, with a small notch above, where it joins the suture; inner lip forming a thick glaze on the pillar, which is slightly excavated above.

Dimensions.—L. 35—85 mm. B. 15—32 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Beaumont, Little Oakley. Newbournian: Waldringfield, Sutton, Felixstowe.[1]

Oligocene: Belgium (Argiles de Boom), North Germany. Miocene: Belgium (Bolderien), Germany, Italy. Pliocene: Belgium—Diestien, Casterlien, Scaldisien, Poederlien. Holland—Scaldisien. Lower Pliocene: Ligurian coast, Castelnuovo d'Asti. Upper Pliocene: Livorno, Bologna; Sicily—Altavilla.

[1] Wood reported *P. intorta* from Butley, but this Mr. Bell thinks was a mistake.

Remarks.—The generic name *Pseudotoma* was proposed by Bellardi in 1875 for a division of the Pleurotomidæ without a distinct keel or obtusely carinated, having a large but shallow labial sinus, a nearly straight columella, and either without, or with only a very short canal.

P. intorta is one of the group of large Pleurotomidæ characteristic of the Miocene and Pliocene of Italy, as well as of the Oligocene and Miocene of other parts of Europe. It is not known from the Coralline Crag or from Walton, and the few specimens which have been met with at later horizons of the Red Crag, principally from the Newbournian, are much worn, leading Wood to regard them as derivative at that horizon.

On the contrary, *P. intorta* is not only said to be abundant in the Miocene of Belgium, but it has been found also in all the divisions of the Pliocene of that region, especially in the Scaldisien of Antwerp, from which M. van de Wouver has obtained more than 100 specimens, perfect and unworn. It would seem probable, therefore, that it continued to exist in the western part of the Anglo-Belgian sea as late at least as the Scaldisien period.

The type of *P. intorta* originally described by Brocchi was a large, coarsely sculptured shell, with a wide, misshapen mouth when adult, like those here represented from Waldringfield and Belgium (Pl. XXVI, figs, 11, 12). A very similar fossil was figured by De Koninck[1] and afterwards by Nyst (*op. cit.*, p. 510) under the name of *P. Morreni*, resembling *P. intorta* in sculpture and form, but with a different mouth. These were regarded by Bellardi, however, as varieties of the same species, and with this I agree, especially as they are connected by the form characteristic of the Lower Pliocene (*argiles bleues*) of the Ligurian coast, a much smaller shell with the general appearance and sculpture of Brocchi's *P. intorta*.

I figure a specimen from my own collection of this variety which I obtained some years ago in northern Italy. Fossils agreeing with the latter have been met with occasionally in the Newbournian Crag, as at Waldringfield.

Var. **Morreni** (S. V. Wood, non De Koninck). Plate XXVI, figs. 15, 16.

1856. *Pleurotoma intorta*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 331, pl. xxxvi, figs. 1, 2.
1867. *Pleurotoma Morreni*, Speyer, Palaeontographica, vol. xvi, p. 196, pl. xxi. figs. 4, 5.
1879. *Pleurotoma Morreni*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 16, pl. ii, fig. 6.
1907. *Pleurotoma intorta*, Ravn, Kongl. Danske Vid. Selsk. Skrift. [7], vol. iii, p. 343, pl. vii, fig. 4.
1913. *Pleurotoma intorta*, Harder, Danm. Geol. Undersøgelse [2], vol. xxii, p. 98, pl. ix, figs. 14, 15.

Varietal Characters.—Shell much smaller and more delicate than the typical *P. intorta*, the spire being more regularly and continuously conical; whorls not so

[1] Mr. Bell informs me that he has found De Koninck's *P. Morreni* in the Suffolk boxstones; he is inclined to think that other boxstone fossils may have been derived similarly from Oligocene deposits.

prominently carinated, the last being two-thirds the total length, excavated below; suture less clearly marked; canal longer and more distinct; mouth wider in proportion; outer lip somewhat expanded.

Dimensions.—L. 30 mm. B. 14 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Waldringfield.

Upper and Middle Oligocene: Denmark. Miocene: Schleswig and Vienna basin.

Remarks.—In addition to the large and coarsely sculptured fossils described above, a smaller and more delicate form has been found, though rarely, in the English Crag, not unlike that figured by Hörnes as *P. intorta*. At first sight the two seem sufficiently distinct to justify our regarding them as separate species, indeed Bellardi, alluding to Hörnes' *P. intorta*, expresses a strong opinion that they are so. These extreme forms, however, appear to be more or less connected by others of an intermediate character, and it may be therefore convenient to group them as varieties of one species. It is Wood's *P. Morreni*, rather than that of De Koninck, that is to say, the smaller of the two, for which I think the varietal name *Morreni* should be reserved.

[Since the above was written I have received some specimens from Dr. Ravn, showing the connection between the two shells. One of these from the Upper Miocene of Denmark, which I have figured (Plate XXVI, fig. 14), corresponds more or less nearly with the Crag form of the typical *P. intorta* and with that from the Italian Pliocene which is smaller. On the other hand, the fossils Drs. Ravn and Harder figure (*op. cit.*), from the Middle Oligocene of Denmark, are what I have called var. *Morreni*, agreeing with my figures 15 and 16 from the Crag and with that given by Hörnes from the Austrian Miocene. Dr. Ravn considers, as I do, that the two forms are distinct, but that the one is a variety of the other.]

Genus **BORSONIA**, Bellardi, 1838.

Borsonia suffolciensis (A. Bell, MS.) sp. nov.

1879. *Borsonia prima* (A. Bell) S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 21, pl. iii, fig. 1.

Specific Characters.—Shell strong, fusiform; whorls slightly convex, depressed above; spire elongate, turreted, regularly tapering; suture slight but distinct; mouth long, narrow, passing without break into the canal; columella with a prominent fold or tooth.

Dimensions.—L. 40 mm. B. 15 mm.

Distribution.—Not known living.

Fossil: Newbournian: Waldringfield (derivative).

Remarks.—The genus *Borsonia* was proposed by Bellardi for a group of shells allied to *Pseudotoma* with a slight sinus and a prominent fold or tooth on the columella. The fossil described by Mr. A. Bell as *Borsonia prima* is one of the large Pleurotomas characteristic of the older Pliocene, and but sparsely represented in the East Anglian Crag. It was found by him at Waldringfield, where it was no doubt derivative from some older deposit of the Anglo-Belgian basin. As the name had been previously used by Bellardi for a different species, Mr. Bell proposes to alter it as above. He still thinks it may be referred to *Borsonia*, although Wood was somewhat doubtful about it.

Genus **OLIGOTOMA**, Bellardi, 1875.

Oligotoma pannus (Basterot). Plate XXVII, figs. 8—11.

1825. *Pleurotoma pannus*, Basterot, Descript. Coq. foss. Bordeaux, p. 63, no. 2.
1832. *Pleurotoma pannus*, Grateloup, Tab. Coq. Dax, p. 331, no. 346.
1847. *Pleurotoma pannus*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 555, no. 10, pl. ii, fig. 1.
1877. *Oligotoma pannus*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 236, pl. vii, fig. 23.
1886. *Genotia* (*Oligotoma*) *pannus*, Dollfus et Dautzenberg, Et. prél. Coq. foss. Touraine, p. 9.
1890. *Oligotoma pannus*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 279, no. 4235.

Specific Characters.—Shell subfusiform, elongato-subulate, not carinated; whorls flat or nearly so, the last more than half the total length; ornamented by well-marked spiral ridges, intersected by rather oblique longitudinal costæ, not very prominent, and by the lines of growth, giving the shell a sub-reticulate appearance; suture slight; apex rather blunt; mouth oval, narrow, angulate above; columella with a distinct fold, excavated above; canal short.

Dimensions.—L. 14—18 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Miocene: France—Touraine, Bordeaux; Italy (Tortoniano, Elveziano).

Remarks.—The generic name *Oligotoma* was proposed by Bellardi for a group of the Pleurotomidæ, *O. Basteroti*, Desm., being taken as the type; they have an acutely elongate spire transversely ridged and cancellated, a short canal, a wide but shallow sinus placed at some distance from the suture and a contorted columella with a distinct fold upon it. He remarks that it may be separated without difficulty from other genera of this family.

I have several worn specimens from Oakley of this species, which is a characteristic form of the Miocene deposits of France and Italy but has not been reported from the Pliocene of those regions; possibly it may be derivative in the English Crag. It may be distinguished by the flatness of the whorls, its somewhat inconspicuous longitudinal sculpture and the absence of the cancellate bands which are rather characteristic of some Crag species, especially of *O. bipunctula* described below. My Oakley fossils agree with some specimens, here figured, from the Faluns of Touraine which I have received from M. Dollfus.

Oligotoma ornata (Defrance). Plate XXVII, figs. 1, 2.

1826. *Pleurotoma ornata*, Defrance, Dict. Sci. Nat., vol. xli, p. 390.
1847. *Pleurotoma pannus*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 555, pl. ii, fig. 2.
1853. *Pleurotoma Heckeli*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 371, pl. xxxix, fig. 20.
1877. *Oligotoma ornata*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 238, pl. vii, fig. 25.
1886. *Genotia* (*Oligotoma*) *ornata*, Dollfus et Dautzenberg, Et. prél. Coq. foss. Touraine, p. 9.
1890. *Oligotoma ornata*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 279, no. 4237.

Specific Characters.—Shell elongato-subfusiform; whorls 10, but slightly convex, depressed above; strongly sculptured longitudinally by numerous and closely set lines of growth and by undulatory spiral ridges which extend to the base of the shell; in the middle of each whorl are bands of well-marked costæ, discontinuous, but elongated longitudinally, as wide as the spaces between them; apex blunt; suture slight; mouth narrow, angulate above; canal open, notched and twisted; columella distorted.

Dimensions.—L. 22 mm. B. 7 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Miocene: Touraine, Italy (Tortoniano, Elveziano), Vienna basin.

Remarks.—I have a single specimen of this very distinct species from Oakley corresponding with one which M. Dollfus has kindly sent me from the Faluns of Touraine. At first it was identified by Bellardi with *O. pannus*, but afterwards, in 1877, with *P. ornata*, Defrance, in which he has been followed by MM. Dollfus and Dautzenberg, and with *P. Heckeli*, Hörnes. It is a characteristic Miocene species which, except for this unique example from Oakley, has not been recorded from any Pliocene deposit. The latter, however, is beautifully perfect, quite unworn, and has the usual appearance and character of a Crag shell.

Oligotoma festiva (Döderlien in Hörnes). Plate XXVII, figs. 5—7.

1856. *Pleurotoma festiva*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 337, pl. xxxvi, fig. 15.
1872. *Pleurotoma festiva*, von Koenen, Mioc. Nord-Deutsch. Moll. Fauna, vol. i, p. 103, no. 116.

1872–9. *Pleurotoma crispata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 35, pl. vi, fig. 13, 1872; *P. pannus*, 2nd Suppl., p. 21, pl. iii, fig. 6, 1879.
1890. *Oligotoma festiva*, E. Vincent, Bull. Soc. Roy. Malac. Belg., vol. xxv, p. 93, figs.
1892. *Pleurotoma festiva*, Van den Broeck, Bull. Soc. Belg. Géol., vol. vi (Mémoires), pp. 121, 132.
1912. *Pleurotoma festiva*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 88, no. 221.

Specific Characters.—Shell elongate, subfusiform, turreted; whorls 8, but little convex, excavated above, slightly carinated, the last about equal in length to the spire; covered with fine thread-like spiral ridges, the keel being ornamented by short and oblique longitudinal plications; suture slight; mouth oval, narrow, angulated above; outer lip gently rounded, not expanded; canal short, somewhat twisted or turning towards the right; columella with a prominent fold.

Dimensions.—L. 18 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Boyton. Waltonian: Little Oakley.

Scaldisien: Belgium, Holland.

Miocene: North Germany, Holland, Belgium, Vienna basin.

Remarks.—I have given below (p. 226) my reasons for thinking that the shell described by Wood (*op. cit.*) as *Pleurotoma crispata* does not accurately represent the Italian fossil known as *Drillia crispata*, Jan, agreeing rather with the Miocene species *O. festiva*, and the same view has been taken by the Belgian and Dutch authorities quoted above. I figure an example from Oakley, which seems to correspond with that of Wood, together with some others from the Coralline Crag and from Antwerp for comparison.

Vincent identified the Scaldisien *Pleurotoma granulina*, Nyst,[1] with *O. festiva*. I understand the type specimen of the former cannot be traced, but if it was correctly drawn, I doubt whether these shells are the same. I have not observed anything like Nyst's figure of *P. granulina* in the East Anglian Crag.

Oligotoma decorata (A. Bell, MS.), sp. nov. Plate XXVII, figs. 3, 4.

Specific Characters.—Shell slender, sub-cylindrical; spire elongate, regularly diminishing in size, not much excavated below; whorls but slightly convex, the last about half the total length; ornamented by spiral ridges with a double line of tubercles just above the suture, and by oblique lines of growth, specially conspicuous on the body-whorl; suture shallow but clearly marked; mouth long, narrow, passing gradually into the canal without a distinct break; outer lip regularly curved, not expanded; canal short; columella sinuous, with a distinct fold upon it.

[1] Conch. Terr. Tert. Belg., p. 43, pl. iii, fig. 7, 1881.

Dimensions.—L. 20 mm. B. 7 mm.

Distribution.—Not known living.

Fossil : Waltonian Crag : Little Oakley. Newbournian : Waldringfield.

Remarks.—One of the specimens now figured is from the Reed collection at the York Museum. It is the one originally found by Mr. A. Bell, and bears his undescribed name of *Pleurotoma decorata*. It is allied to *O. bipunctula*, but is larger and more strongly sculptured; among a number of specimens it can be separated without difficulty. I have obtained six or eight similar examples at Oakley which appear to be the same. None of them have the smooth or polished appearance usually shown by this group of shells. This form might be found probably at other Crag localities if specially looked for.

Oligotoma bipunctula (S. V. Wood). Plate XXVII, figs. 12—15; Plate XXVIII, figs. 5—8.

1848. *Pleurotoma semicolon*, S. V. Wood, Mon. Crag Moll., pt. i, p. 54, pl. vi, fig. 3 *b*.
1879. *Pleurotoma bipunctula*, S. V. Wood, 2nd Suppl., p. 36.

Specific Characters.—Shell small, subfusiform, turreted; whorls but slightly convex, not keeled; spire elongato-conical, ending in a blunt point; ornamented by rather strong spiral ridges, two of which near the base of the whorls are connected longitudinally so as to become cancellate; suture slight; mouth oval, narrow, angulate above, ending in a short symmetrical canal; columella sinuous; outer lip regularly rounded.

Dimensions.—L. 12 mm. B. 5 mm.

Distribution.—Not known living.

Fossil : Coralline Crag : Gedgrave. Waltonian : Little Oakley. Newbournian : Sutton, Waldringfield; probably elsewhere in the Red Crag.

Scaldisien : Belgium.

Remarks.—Among many specimens of the present group from Oakley, most of them rather worn, I have about a dozen which, agreeing more or less nearly with Wood's figure of *Pleurotoma bipunctula*, separate themselves from the other Crag Oligotomas by their form and sculpture. I have two separate varieties of this species which at first I was disposed to regard as distinct, the one represented by Pl. XXVIII, figs. 5 and 6, the other by figs. 7 and 8. On the whole, I think it is better to unite them under the present name. The correct determination of these nearly allied and often imperfect fossils is always a matter of difficulty, and sometimes of doubt. The present form and the one next to be described have not been recorded except from the Pliocene deposits of the Anglo-Belgian basin.

Var. **proxima**, nov. Plate XXVIII, figs. 3—4.

Specific Characters.—Differs from the type in size, form and sculpture; whorls 8—9, nearly flat, regularly diminishing upwards, the last about half the total length, excavated below; ornamented by rather coarse but not very prominent spiral lines, some of them forming obscure cancellate bands on the upper whorls; suture slight; spire elongate, acutely conical; mouth short, narrow, passing without break into a very short canal; outer lip gently curved, not expanded, continuous with the outline of the spire; columella flexuous.

Dimensions.—L. 12—17 mm. B. 5—6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Boyton. Waltonian: Little Oakley. Newbournian: Waldringfield.

Remarks.—The specimens (Pl. XXVIII, figs. 3, 4) figured under the present name are from the British Museum, where a difficulty similar to my own has been felt as to their correct identification, the one from Waldringfield (fig. 4) being labelled *Pleurotoma decorata*, A. Bell, the other from Boyton (fig. 3) *Drillia Loprestiana*, Calcara. The two seem to be, however, if not actually the same, very nearly allied. As to the first of these I have on Pl. XXVII, fig. 3 figured Mr. Bell's undescribed type specimen of *Pleurotoma decorata* in the York Museum as *Oligotoma decorata*. It is not the same as the one in question from the British Museum. As to the second, *P. Loprestianum* was named but not figured by Calcara, but there seems some doubt as to what it really was. Prof. Kobelt has represented two different forms under the latter name (in his text, not on his plate),[1] one of which he identifies with *P. crispatum* of Reeve,[2] the other with *P. crispatum* of Philippi,[3] but with neither of them do our fossils correspond. In sculpture they approach the typical *O. bipunctula*, but differ from it in form, especially in the flatness of the whorls and their elongated spire. Pl. XXVIII, figs. 5—8, seem to represent a variety intermediate between the present shell and *O. bipunctula*.

Genus **DRILLIA**, Gray, 1838.

Drillia Brocchii (Bonelli). Plate XXVII, figs. 20, 21.

Pleurotoma Brocchii, Bonelli, MS. Cat., no. 269.

1814. *Murex oblongus*, Brocchi (non Renieri), Conch. foss. Subap., p. 429, pl. viii, fig. 5.

1847. *Pleurotoma Brocchii*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 605, pl. iv, fig. 7.

---

[1] Icon. schalentrag. europ. Meeresconch., vol. iii, p. 223, pl. lxxxi, figs. 8—10, 1905.

[2] Icon. Conch., vol. i (Pleurotoma), pl. xix, fig. 156, 1844.

[3] Enum. Moll. Siciliæ, vol. ii, p. 170, pl. xxvi, fig. 12, 1844.

1875. *Pleurotoma Brocchii*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 206, no. 147.
1877. *Drillia Brocchii*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 101, pl. iii, fig. 26.
1890. *Drillia* (*Crassispira*) *Brocchii*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 270, no. 4014.

Specific Characters.—Shell thick and strong, turreted; whorls channelled near the centre, the channels being wide but not deep; ornamented by fine undulating spiral striæ, stronger and more distant on the lower part and on the back of the body-whorl, and by about ten obtuse and oblique longitudinal costæ, not very prominent, which do not reach the base of the shell, with wide spaces between them; suture slight; mouth oval, slightly expanded above, narrowing towards the canal, which is straight and very short.

Dimensions.—(Of Crag specimens) L. 20 mm. B. 7 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Beaumont, Little Oakley (probably derivative).

Miocene: Touraine. Upper Pliocene: France—Biot; Italy—Asti, Bologna, Livorno.

Remarks.—The Drillias are a group of the Pleurotomidæ having a turriculate spire, a comparatively short body-whorl and a short and recurved canal; the inner lip is generally thickened, the outer lip reflexed, with a well-marked labial sinus and sometimes a pad-like swelling near the suture.

I have found several shells at Beaumont and Oakley, more or less imperfect, unlike anything hitherto reported from the English Crag. Submitting them to my friend Prof. Sacco, of Turin, he was kind enough to send me a specimen of *Drillia Brocchii* from the Upper Pliocene of Piedmont, to which species he thinks they may be referred. My fossils are somewhat smaller, but probably do not differ from the type form more than might be expected considering that they lived in areas so widely apart. From their appearance I should conclude they are derivative in the Crag. The study of such derivative forms is important, as it may enable us to form a better idea as to the general character of the well-nigh lost molluscan fauna of the North Sea region during the Miocene and older Pliocene epochs.

Drillia icenorum (S. V. Wood). Plate XXVII, figs. 16, 17.

1848. *Pleurotoma semicolon ?*, S. V. Wood, Mon. Crag Moll., pt. i, p. 54, pl. vi, fig. 3 *a*.
1879. *Pleurotoma icenorum*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 19, pl. iii, fig. 8.

Specific Characters.—Shell strong, ovato-elongate; whorls 7, convex, carinated, regularly diminishing in size, the last much the largest, less than half the total length; ornamented by a single row of prominent rounded nodules on the keel, and by well-marked spiral ridges below it, especially on the body-whorl; apex blunt;

suture distinct; mouth oval, angulate above; canal very short, twisted, wide and open; inner lip forming a glaze on the pillar, with a small umbilicus to the left of it; pillar flexuous.

Dimensions.—L. 16—18 mm. B. 6—7 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton, Gedgrave, Boyton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Waldringfield. Scaldisien: Antwerp.

Remarks.—In Wood's Monograph of 1848 (*op. cit.*) two very distinct shells were referred to *P. semicolon*, Sowerby, an Eocene species from Bracklesham. Recognising subsequently the difference between them, as well as from the latter, he proposed that the one should be known as *P. icenorum*, the other as *P. bipunctula*, both of which specific names I adopt.

The former, that now in question, resembles *P. denticula* in sculpture, but is easily distinguished from it, being a true *Drillia*. It is not a very abundant Crag shell, but may be found in most collections, generally from the earlier horizons. It has been reported from several localities in the Coralline Crag. Prof. Kendall obtained it at Walton, I have several imperfect specimens from Oakley, and there is one from Waldringfield in the Ipswich Museum. I have another, moreover, in my collection from the Scaldisien of Antwerp. The generally unworn condition of these fossils lends but little support to the view that they are derivative.

The typical *D. icenorum* is only known from the Pliocene beds of the Anglo-Belgian basin. Prof. von Koenen identifies it doubtfully with *Pleurotoma Hosiusi*,[1] but from a specimen of the latter which he has kindly sent me for comparison I believe they are quite different.

Var. **elongata**, nov. Plate XXVII, fig. 18.

1872. *Pleurotoma coronata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 32, pl. vi, fig. 4.

Dimensions.—L. 20 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Boyton. Newbournian: Waldringfield.

Remarks.—This form, the type specimen of which is in the Ipswich Museum, seems to be merely an elongated and slender variety of *D. icenorum*. There are two others from the Coralline Crag of a somewhat intermediate character at York.

The Miocene species to which the present form was referred by Wood is a true

[1] Mioc. Nord-Deutsch. Moll. Faun., vol. i, p. 105, pl. ii, fig. 12, 1872.

Pleurotoma, with a fairly long, straight and narrow canal (see Hörnes, Foss. Moll. Tert. Wien, pl. lii, fig. 9). I do not think our Crag fossil is the same as the latter.

Var. **speciosa**, nov. Plate XXVII, fig. 19.

Varietal Characters.—Differs from the type in its very slender form, more elongate spire and more delicate sculpture.

Dimensions.—L. 16 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave.

Remarks.—This very charming little shell is from the Jermyn Street Museum. It seems to group itself with figures 16, 17 and 18 of Pl. XXVII, and may be regarded, I think, as a variety of *D. icenorum*.

Drillia incrassata (Dujardin). Plate XXVII, fig. 28.

1837. *Pleurotoma incrassata*, Dujardin, Mém. Conch. Tour., p. 292, pl. xx, fig. 28.
1838. *Pleurotoma Maravignæ*, Bivona, Spec. Nov. Pleur., p. 8, pl. i, fig. 3.
1844. *Pleurotoma elegans*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 168, pl. xxvi, fig. 5.
1848. *Pleurotoma incrassata*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 383, pl. xl, fig. 14.
1871. *Conopleura Maravignæ*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 488.
1873–5. *Conopleura elegans*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 119, 1873; *C. Maravignæ*, vol. vi, p. 206, no. 171, 1875.
1877. *Drillia incrassata*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 140, pl. v, fig. 1.
1879. *Drillia incrassata*, Fontannes, Moll. Plioc. Vall. du Rhone, p. 46.
1890. *Crassopleura Maravignæ*, Carus, Prod. Faun. Medit., vol. ii, p. 414.
1914. *Drillia* (*Cymatosyrinx*) *incrassata*, Cipolla, Palaeont. Ital., vol. xx, p. 122, pl. xii, fig. 10.

Specific Characters.—Shell small, slender in the type form; spire elongate, ending in a blunt apex; whorls but slightly convex; ornamented with oblique or sinuous costæ extending to the base of the shell, which in the type are fine and numerous, but in the various varieties are less so; suture slight; mouth short, oval, wide; inner lip thickened with a small pad at the top forming one side of the labial notch, which is deep and well marked; canal wide, open, very short.

Dimensions.—L. 10 mm. B. 3·5 mm.

Distribution.—Recent: Mediterranean, Adriatic, Ægean, Algeria, Tunis, Atlantic coasts of Spain and Portugal.

Fossil: Coralline Crag: Gedgrave (Jeffreys). Waltonian: Little Oakley. Newbournian: Sutton.

Miocene: Touraine, Italy (all zones), Vienna basin. Lower Pliocene: Italy—Albenga; France—Rhone Valley. Upper Pliocene: Italy—Asti; Sicily—Altavilla. Pleistocene: Palermo, Reggio, Gravina, Calabria.

Remarks.—Mr. A. Bell informs me he met with this species many years ago in the Red Crag of Sutton, the specimen being quoted in Prestwich's list on the authority of Gwyn Jeffreys under the name of *Conopleura Maravignæ* (*op. cit.*). The latter authority gives it also from the Coralline Crag of Gedgrave. It is not very rare at Oakley, from which place I have obtained several well-marked varieties. Most of my specimens are worn, and might be regarded as derivative were it not that one variety (var. *Nysti*) occurs in the Scaldisien of Belgium, where there is no suggestion of derivation.

One or two of my Oakley fossils correspond more or less nearly with the multicostate form figured by Bellardi, but as they are worn I give a perfect specimen of this variety from the Italian Pliocene. *Drillia incrassata* has a wide range in time and space. It occurs in the Miocene, both of France and Germany, as well as at all stages of the Pliocene and Pleistocene of Italy and Sicily. It is reported under the name of *Conopleura Maravignæ* as living in all parts of the Mediterranean, and on the coasts of Spain and Portugal.

Var. **dertomagna,** Sacco. Plate XXVII, fig. 29.

1847. *Raphitoma incrassata,* Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 636, pl. iv, fig. 27.
1877. *Drillia incrassata,* var. *D,* Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 142, pl. v, fig. 2.
1890. *Drillia incrassata,* var. *dertomagna,* Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 273, no. 4088.
1904. *Drillia* (*Cymatosyrinx*) *incrassata,* var. *dertomagna,* Sacco, Moll. Terr. Terz. Piem., pt. xxx, p. 47.

Dimensions.—L. 10 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Waldringfield.

Miocene (Tortoniano): Italy.

Remarks.—I have a dozen fossils from Oakley which evidently belong to the *incrassata* group, but differ from the type in that they are stronger, not so slender in form, with fewer longitudinal costæ. In M. Dollfus' opinion they may be referred to Prof. Sacco's variety *dertomagna.*

Var. **miominor (?),** Sacco. Plate XXVII, fig. 30.

1877. *Drillia incrassata,* var. *C,* Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 142.
1890. *Drillia incrassata,* var. *miominor,* Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 273, no. 4087.
1904. *Drillia* (*Cymatosyrinx*) *incrassata,* var. *miominor,* Sacco, Moll. Terr. Terz. Piem., pt. xxx, p. 47, pl. xii, fig. 48.
1914. *Drillia* (*Cymatosyrinx*) *incrassata,* var. *miominor,* Cipolla, Palaeont. Ital., vol. xx, p. 123, pl. xii, fig. 12.

Dimensions.—L. 14 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gomer Pit.

Miocene: Italy—Colli torinesi. Upper Pliocene: Altavilla.

Remarks.—The shell figured under this name is from the Gomer pit at Gedgrave, now unfortunately closed, from which so many interesting specimens were formerly obtained.

Although worn, with the costæ nearly obliterated, it seems to correspond more or less nearly with one of Prof. Sacco's figures (*q. v.*) of his var. *miominor*. It is, however, larger than the Italian fossil, to which I provisionally refer it. Dr. Cipolla reports this variety from the Upper Pliocene of Altavilla.

Var. **crassa** (A. Bell). Plate XXVII, fig. 32.

1871. *Conopleura crassa*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 358.
1872. *Pleurotoma crassa*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 37, pl. vii, fig. 10.
1890. *Drillia crassa*, E. Vincent, Bull. Soc. Roy. Malac. Belg., vol. xxv, p. 98 (fig.).
1892. *Drillia crassa*, Van den Broeck, Bull. Soc. Belge Géol., vol. vi (Mémoires), p. 122.
1912. *Drillia crassa*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 92, no. 237.

Varietal Characters.—Shell rather thick, subfusiform; spire conical; longitudinal ribs fewer in number than in the type, and confined to the upper whorls; spire more elongate than in var. *dertomagna*.

Dimensions.—L. 16 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Newbourn. Butleyan: Butley.

Scaldisien: Antwerp, Dutch borings.

Remarks.—I have shown my Oakley specimens of the shell figured under this name to Mr. Bell, who has identified them with that described by him in 1871. It has been regarded by himself and others as specifically distinct from *D. incrassata*. Comparing it with the type of that species, there seems some reason for this view, but if we admit the other allied forms such as var. *dertomagna* to be varieties, it will be difficult to keep the present one distinct. They belong to one group, and, on the whole, I prefer to associate them under the same name.

Var. **Nysti**, nov. Plate XXVII, fig. 31.

1881. *Pleurotoma incrassata*, Nyst, Conch. Terr. Tert. Belg., p. 45, pl. iii, fig. 10.

Dimensions.—L. 14 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Butleyan: Butley. Scaldisien: Antwerp.

Remarks.—The Oakley fossil figured under the above name, although differing materially from the form I have taken as typical of *D. incrassata*, seems to belong to the same group. It is less delicate than the type, with much coarser sculpture, differing from the varieties *dertomagna* and *crassa*, in which the longitudinal costæ are more numerous, less prominent, and generally confined to the upper whorls, while the spire is slender and elongate. It approaches very nearly the shell described by Nyst as *Pleurotoma incrassata*, with which I propose to associate it, dedicating it to that distinguished scientist as a variety of what was evidently in Pliocene times a very variable form. Like the latter they have the deep and rounded labial sinus with the pad on the inner lip characteristic of this species, which unfortunately, in the present case, the artist has not clearly shown.

Drillia sigmoidea (Bronn). Plate XXVII, figs. 24, 25.

1831. *Pleurotoma sigmoidea*, Bronn, Ital. Tert. Geb., p. 47.
1847. *Raphitoma sigmoidea*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 637, pl. iv, fig. 29.
1853. *Pleurotoma Suessi*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 384, pl. xl, fig. 13.
1875. *Conopleura sigmoidea*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 206, no. 172.
1877. *Drillia sigmoidea*, Bellardi, Moll. Terr. Tert. Piem., pt. ii, p. 144, pl. v, fig. 4.
1890. *Drillia sigmoidea*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 273, no. 4091.

Specific Characters.—Shell turreted; whorls strongly convex, tapering to a fine point, longitudinally costate, costæ prominent, sigmoid, separated by wide furrows, hardly reaching the base of the shell; suture deep; mouth wide, with a short canal; labial notch large, with a pad on the inner lip as in *D. incrassata;* base striated.

Dimensions.—L. 12—14 mm. B. 4—5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Newbourn.

Miocene: Italy (Tortoniano), Vienna basin. Lower Pliocene: Italy—Ligurian coast, Castelnuovo d'Asti. Upper Pliocene: Biot, Bologna, Livorno; Sicily—Altavilla.

Remarks.—I have two or three specimens from Oakley which correspond more or less nearly with some of the present species which I brought from the Italian Pliocene of Albenga. They are rather worn, but not too much so for identification. The Messrs. Ogden, however, have recently found another, perfect and fresh, at Newbourn, which is here figured. This form may be recognised by its convex whorls, its deep suture and sigmoid costæ; it is allied to *D. incrassata*, but both Bellardi and Prof. Sacco consider it a separate species. It has rather an extended range in time, from the Miocene of Italy and the Vienna basin to the Upper Pliocene of Sicily and the English Crag. I see no reason for considering it derivative in the latter.

Var. **pliomagna,** Sacco. Plate XXVII, fig. 26.

1877. *Drillia sigmoidea*, var. *A*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 145.
1890. *Drillia sigmoidea*, var. *pliomagna*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 273, no. 4092.
1904. *Drillia* (*Cymatosyrinx*) *sigmoidea*, var. *pliomagna*, Sacco, Moll. Terr. Terz. Piem., pt. xxx, p. 47, pl. xii, figs. 49, 50.

Varietal Characters.—Differs from the type in being larger, more robust and less slender and delicate, with stronger sculpture; the whorls are less convex, and the suture not so deep.

Dimensions.—L. 15 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Waldringfield.

Lower Pliocene: Northern Italy.

Remarks.—The shell figured under the present name was found at Waldringfield and belongs to the Ipswich Museum. It seems to correspond with that represented by Prof. Sacco from the Italian Pliocene under the present name, which he identifies with the variety *A* of *D. sigmoidea*, described by Bellardi in 1877, but not figured. It has the sigmoid ribs of the type form, but is a stronger and larger form, with coarser sculpture and is distinct from the latter. Bellardi speaks of it as being rare in the Italian Pliocene.

Drillia crispata (Jan). Plate XXVII, figs. 22, 23.

1832. *Pleurotoma crispata*, Jan, Cat. rer. nat. Mus. Crist. Jan, p. 9, no. 25.
1847. *Pleurotoma crispata*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 597, pl. iv, fig. 2.
1853. *Pleurotoma crispata*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 367, pl. xxxix, fig. 13.
1872. *Pleurotoma crispata*, von Koenen, Mioc. Nord. Deutsch., pt. i, p. 101, no. 114.
1873. *Pleurotoma crispata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 296, no. 80.
1877. *Drillia crispata*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 131, pl. iv, fig. 21.
1890. *Drillia crispata*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 272, no. 4069.

Specific Characters.—Shell rather small, slender, subfusiform; whorls 8—10, excavated above, the last about half the total length; ornamented by well-marked spiral ridges, three on the upper whorls, and extending to the base. The upper ridge is the most prominent, forming a distinct keel, which in the type is faintly denticulate in the uppermost whorls, and in var. *papillosa* on the lower ones also; spire elongate; apex acute; suture margined by the lowest spiral ridge; mouth ovate, narrow, passing into a short and nearly straight canal.

Dimensions.—L. 14 mm. B. 4 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Miocene: North Germany, Vienna basin, Italy. Lower Pliocene: Italy—Castelnuovo d'Asti, Ligurian coast. Pleistocene: Italy—Reggio, Válle Biaia; Sicily—Ficarazzi.

Remarks.—I have a fossil from Oakley which, though rather worn, is perfect, and corresponds in form with some specimens of *D. crispata* in my collection from the *argiles bleues* of the Ligurian coast, one of which I have figured for comparison with it. This species is a characteristic, though not a very abundant, form of the Middle and Upper Miocene of northern Italy, occurring also in the Piacenziano of Piedmont and Liguria. Prof. Sacco records it doubtfully from the Astian deposits.

The shell from the Coralline Crag, figured by Wood as *Pleurotoma crispata*, var. *papillosa* (Mon. Crag Moll., 1st Suppl., p. 35, pl. vi, fig. 13), is, I think, of another species. I have described it in the present Memoir as *Oligotoma festiva* (see p. 216). Reeve's *Pleurotoma crispata* (Conch. Icon., vol. i, Pleurotomidæ, pl. xix, fig. 156) is also a different shell.

Drillia emendata (Monterosato). Plate XXX, fig. 40.

1844. *Pleurotoma Renieri*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 176, tav. xxvi, fig. 22.
1871. *Pleurotoma Renieri*, Jeffreys, in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.
1872. *Pleurotoma emendata*, Allery, Not. Conch. foss. Mte. Pellegr. e Ficar., pp. 17, 34.
1873–5. *Pleurotoma emendata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 296, no. 82, 1873; vol. v, p. 276, no. 33, 1874; vol. vi, p. 206, no. 166, 1875.
1874. *Pleurotoma* (*Taranis*) *emendata*, Monterosato, Journ. de Conch., vol. xxii, p. 278.
1890. *Pleurotoma emendatum*, Carus, Prod. Faun. Medit., p. 413.
1903. *Drilliola emendata*, Cossmann, Ess. Paléoconch. comp., vol. v, p. 188.
1905. *Homotoma* (*Teretia*) *emendatum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 222, pl. lxxxi, figs. 14, 15.
1914. *Drillia* (*Drilliola*) *emendata*, Cipolla, Palaeont. Ital., vol. xx, p. 120, pl. xii, fig. 8.

Specific Characters.—Shell minute, fusiform, turreted; whorls 7, but slightly convex; the upper ones ornamented by three raised spiral ridges, the middle one being the most prominent, the upper part of the whorls by the oblique lines of growth; body-whorl multicingulate; suture distinct; mouth oblong; canal short.

Dimensions.—L. 9 mm. B. 4 mm.

Distribution.—*Recent:* Mediterranean, Adriatic, West European.

Fossil: Coralline Crag: Gedgrave, Sutton. Upper Pliocene: Sicily—Altavilla. Pleistocene: Ficarazzi, Monte Pellegrino, Castroreale.

Remarks.—There is a fragmentary specimen from the Coralline Crag of Sutton in the Wood Collection at the Norwich Museum labelled in his own writing *Pleurotoma Renieri*, which corresponds, so far as it goes, with one from the Pleistocene deposit of Ficarazzi near Palermo, kindly sent me by the Marchese di Monterosato, which I have figured.

Jeffreys gives this species from Gedgrave in his list of Crag Mollusca published with Prestwich's paper.

Drillia galerita (Philippi).

1844. *Pleurotoma galeritum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 172, pl. xxvi, fig. 15.
1847. *Pleurotoma Rochettæ*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 597, pl. iv, fig. 1.
1869. *Pleurotoma galerita*, Jeffreys, Brit. Conch., vol. v, p. 221, pl. cii, fig. 6.
1875. *Pleurotoma galerita*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 206, no. 162.
1877. *Drillia galerita*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 123, pl. iv, fig. 13.
1889. *Drillia galerita*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 272, no. 4056.
1890. *Pleurotoma Galeritum*, Carus, Prod. Faun. Medit., vol. ii, p. 414.

Specific Characters.—Shell small, solid; whorls slightly concave above, distinctly keeled, the keel being placed in the centre of each whorl and ornamented by a single row of tubercles; the spiral sculpture consists otherwise of minute and closely-set lines above the keel, and somewhat stronger and more distant ones below it on the body-whorl; suture distinct; mouth oval, angulated above and by the keel; outer lip thin; canal short, turning slightly to the left; columella sinuous, excavated above.

Dimensions.—L. 12 mm. B. 5 mm.

Distribution.—Recent: Mediterranean, Atlantic to Western Hebrides and Shetland.

Fossil: Waltonian Crag: Little Oakley.

Lower Pliocene: North Italy. Upper Pliocene: Sicily—Altavilla.

Remarks.—I have found several specimens at Oakley, some a good deal worn, which correspond more or less closely with Bellardi's figures of *D. galerita*. They are not unlike that described under the same specific name by Jeffreys (*op. cit.*), which he states was dredged from a depth of 196 fathoms in the Western Hebrides about fifty miles north of the Butt of Lewis. None of these agree altogether with Philippi's original figure, but as that was an enlargement of a much smaller shell it is possible the artist did not represent it very accurately. Bellardi, however, identifies his Italian Pliocene fossils and Jeffreys' specimen with Philippi's species. On the other hand, Prof. Kobelt doubts whether Jeffreys' identification was correct, regarding his shell as *P. semicolon* = *Drillia icenorum*, S. V. Wood,[1] a view I am unable to accept (*cf.* Pl. XXVII, figs. 16, 17). I prefer to follow Bellardi's grouping of the shells in question, referring doubtfully with them my Oakley fossils to Philippi's *P. galeritum*.

[1] Icon. schalentrag. europ. Meeresconch., vol. iii, p. 332, pl. lxxxi, figs. 22, 23.

Drillia terebra (Basterot). Plate XXVII, fig. 33.

1825. *Pleurotoma terebra*, Basterot, Descript. Coq. foss. Bordeaux, p. 66, pl. iii, fig. 20.
1840. *Pleurotoma terebra*, Grateloup, Atlas Conch. foss., pl. xx, fig. 23.
1847. *Pleurotoma terebra*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 606.
1877. *Drillia terebra*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 107, pl. iii, fig. 33.
1886. *Drillia terebra*, Dollfus et Dautzenberg, Et. prél. Coq. foss. Tour., p. 10.
1890. *Drillia terebra*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 270, no. 4024.

Specific Characters.—Shell small; spire long, slender, acute; whorls nearly flat, the last depressed, short, less than half the total length; suture superficial; mouth oval, terminating in a short and open canal.

Dimensions.—(Of Crag specimens): L. 12 mm. B. 3 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Miocene: Italy (Elveziano), south-west France, Touraine.

Remarks.—I have two or three specimens from Oakley, one of which is here figured. They are too much worn to show the characteristic longitudinal sculpture of Basterot's *Pleurotoma terebra*, but otherwise resemble some fossils I obtained from the Faluns of Touraine, both in size and form. M. Dollfus, to whom I have submitted my Oakley fossils, considers they may be referred to that species. They do not agree so nearly with the Italian shell, which is larger, nor with the figure of it given by Bellardi, as with the Touraine form. This species is very distinct, differing from other Pleurotomidæ by its slender character.

Drillia Kendalli, sp. nov. Plate XXVIII, fig. 2.

1872. *Pleurotoma Tarentini?*, S. V. Wood, Mon. Crag Moll., 1st Suppl. pt. i, p. 34, pl. iii, fig. 5.

Specific Characters.—Shell remarkably slender, spindle-form; whorls 7, flat, the last about two-thirds the total length; spire elongate, ending in a blunt, rounded apex; suture very slight; ornamented by fine, clearly sculptured and rather distant spiral ridges, the first, immediately below the suture, being separated from those under it by a well-marked space without sculpture; mouth long, very narrow, continuous with a short and open canal; columella nearly straight.

Dimensions.—L. 11 mm. B. 3·5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Sutton.

Remarks.—The specimen figured under this name, after Prof. P. F. Kendall, one of the first to study seriously, in association with the late R. G. Bell, the molluscan fauna of Walton-on-Naze, is from the York Museum, where it is labelled

Pleurotoma Renieri (*Tarentini*), but it does not seem to me to correspond with the type figures of either of them. It is no doubt the same as that described by Wood under the latter name; in that species, however, as shown in Philippi's original drawing of *P. Tarentini*, the greatest transverse diameter is nearer the base of the shell and the body-whorl is wider in proportion.

D. Kendalli is a very charming as well as a very distinct shell, and I can find nothing to which it can be satisfactorily referred.

Genus **SPIROTROPIS**, G. O. Sars, 1878.

Spirotropis modiola (Jan). Pl. XXVIII, figs. 9—12.

1832. *Fusus modiolus*, Jan, Cat. rer. nat. Mus. Crist. Jan, p. 10, no. 17.
1844. *Pleurotoma carinatum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 176, pl. xxvi, fig. 19.
1847. *Pleurotoma modiola*, Bellardi, Mem. R. Accad. Sci. Torino, vol. ix, p. 596, pl. iii, fig. 9, no. 54.
1848–72. *Pleurotoma carinata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 54, pl. vi, fig. 2, 1848; *P. modiola*, 1st Suppl., p. 34, 1872.
1856. *Pleurotoma modiola*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 366, pl. xxxix, fig. 12.
1869. *Pleurotoma carinata*, Jeffreys, Brit. Conch., vol. v, p. 221, pl. cii, fig. 7.
1873–5. *Pleurotoma carinata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 296, no. 84, 1873; vol. v, p. 276, no. 32, 1874; *P. modiola*, vol. vi, p. 206, no. 163, 1875.
1877. *Drillia modiola*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 129.
1878. *Spirotropis carinata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 242, pl. xvii, fig. 5.
1881. *Pleurotoma modiola*, Nyst, Conch. Terr. Tert. Belg., p. 54, pl. xxxviii, fig. 11.
1890. *Pleurotoma modiola*, Carus, Prod. faun. Medit., vol. ii, p. 413.
1896. *Spirotropis carinata*, Cossmann, Ess. Paléoconch. comp., vol. ii, p. 88, pl. v, figs. 26, 27.
1905. *Spirotropis modiola*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 297, pl. lxxxi, figs. 4, 5.
1906. *Spirotropis modiolus*, Sykes, Proc. Malac. Soc., vol. vii, p. 184.
1907. *Pleurotoma modiola*, Ravn, Kgl. Danske Vid. Selsk. Skrift. [7], vol. iii, p. 356, pl. viii, fig. 6.
1912. *Pleurotoma modiola*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 88, no. 223.

Specific Characters.—Shell fusiform, turreted, solid; whorls 9—10, regularly diminishing in size, the last about half the total length, ornamented by a central keel, prominent and sharply edged, the upper part of the whorls being slightly concave; spire elongate, ending in a sharp but obtuse apex; mouth oval; labial sinus large, deeply cut, outer lip angulated by the keel; canal narrow and straight.

Dimensions.—L. 18—24 mm. B. 6—9 mm.

Distribution.—Recent: Finmark, Lofoten Islands, western coasts of Norway, Hebrides (Jeffreys), Calabria, Palermo.

Fossil: Coralline Crag: Gedgrave, Gomer pit, Boyton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Sutton, Waldringfield. Miocene: Denmark, North Germany (v. Koenen), Vienna basin, Italy. Upper

Pliocene (Casterlien, Scaldisien): Antwerp. Scaldisien: Holland; Sicily—Altavilla, Messina; Italy—Calabria, Reggio, Santa Cristina, Monastirace, Gerace. Pleistocene: Ficarazzi, Barcelona-Castroreale.

Remarks.—Originally grouped with *Pleurotoma* and afterwards with *Drillia*, the present shell is now usually identified with the Recent Norwegian *Spirotropis carinata* of Prof. G. O. Sars, the characteristic features of *Spirotropis* being a wide labial sinus close to the suture, a globular embryo, and the absence of sculptures on the spine.

S. modiola is recorded from the Miocene of North Germany, the Vienna basin, Denmark (Upper), North Italy (Middle and Upper), but not from the Pliocene of the latter region. It occurs, however, according to Seguenza, at many places in the Upper Pliocene and Pleistocene of Calabria and Sicily. It has been found in the Coralline, Waltonian and Newbournian Crags, and at several Pliocene horizons in Belgium and Holland.

Unfortunately all the Crag specimens known to me but one have the outer lip too imperfect to show the characteristic labial notch; but in one from the Sedgwick Museum at Cambridge, now figured, it may be clearly traced. This feature is represented in Hörnes' figure of *P. modiola* (*op. cit.*), but not by any other of the authors quoted above.

M. Cossmann doubts whether the fossil species here described is truly equivalent to the Recent form, for which he adopts Bivona's specific name of *carinata*. He considers, however, that the Crag fossils with those from the Pliocene and Pleistocene of Sicily, are of an intermediate character. It seems desirable, therefore, to figure with our Crag shells a Recent example of the Norwegian *S. carinata* for comparison. I do not think the former can be separated from those of the Miocene beds. In any case we cannot be wrong to retain the older name, *S. modiola*, in our Crag lists.

In the fifth volume of the British Mollusca (pl. cii, fig. 7) Jeffreys figures a small specimen under the present name; if it is correctly drawn I cannot but think his identification is open to doubt.

According to Seguenza and others *S. modiola* still lingers on in the Mediterranean.

Genus **CLATHURELLA**, Carpenter, 1857.

Clathurella purpurea (Montagu). Plate XXVIII, figs. 16, 17.

1803. *Murex purpureus*, Montagu, Test. Brit., pt. i, p. 260, pl. ix, fig. 3.
1842. *Pleurotoma purpureum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 165.
1848. *Clavatula Philberti*, S. V. Wood, Mon. Crag Moll., pt. i, p. 57, tab. vii, fig. 5.
1853. *Mangelia purpurea*, Forbes and Hanley, Brit. Moll., vol. iii, p. 465, pl. cxiii, figs. 3, 4.

1867. *Defrancia purpurea*, Jeffreys, Brit. Conch., vol. iv, p. 373, pl. lxxxix, fig. 5.
1870. *Defrancia purpurea*, A. Bell, Journ. de Conch., vol. xviii, p. 348, no. 294.
1872. *Defrancia purpurea*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 213.
1873–5. *Defrancia purpurea*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 127, 1873; vol. vi, p. 208, no. 190, 1875.
1877. *Homotoma purpurea*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 270.
1883. *Clathurella purpurea*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 90, pl. xiv, figs. 6, 7.
1889. *Defrancia purpurea*, A. Bell, Proc. Roy. Phys. Soc. Edin., vol. x, p. 296.
1890. *Clathurella purpurea*, Carus, Prod. Faun. Medit., vol. ii, p. 425.
1901. *Clathurella purpurea*, Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 661.
1905. *Clathurella* (*Philbertia*) *purpurea*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 359, pl. xcv, figs. 21—23.
1910. *Peratotoma purpurea*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 58, pl. v, figs. 34, 35.

Specific Characters.—Shell subturriculate, elongated, rather solid; whorls convex and rounded; ornamented by numerous longitudinal ribs, not very prominent, closely crowded together, and by well-marked, regular, wavy and equidistant transverse ridges, becoming slightly granular where they cross the ribs, and giving the shell a clathrate appearance; suture fairly deep; apex acute; mouth ovate, contracted and angulate above; labial sinus clearly marked; outer lip thickened and strongly denticulate within; canal distinct, short, open.

Dimensions.—L. 12—22 mm. B. 4—8 mm.

Distribution.—Recent: Mediterranean, Adriatic, Ægean, Atlantic from the Canaries northwards to Great Britain (southern and western coasts), Skye and Shetland, Christiansand, Bergen, Bohuslan.

Fossil: Coralline Crag: Sutton, Boyton. Waltonian: Walton-on-Naze (A. Bell), Little Oakley. Butleyan: Butley. Holocene: Portrush.

Upper Pliocene: Italy—Piedmont, Monte Mario; France—Biot; Sicily—Altavilla.

Pleistocene: Italy—Livorno, Taranto, Válle Biaia; Sicily—Monte Pellegrino, Ficarazzi, Catania.

Tapes and Isocardia banks: Christiania (Brøgger), Trondhjem (Øyen).

Remarks.—The generic name *Clathurella* was substituted for *Defrancia* (Millet, 1826), the latter having been proposed the year before for a group of Polyzoa. It has been used for some small shells allied to *Mangilia*, having a clathrate sculpture, and has been divided lately into several sub-genera. Italian conchologists have adopted the generic name of *Peratotoma*, with several sub-divisions, for the present group and some other shells.

Although *C. purpurea* and some other nearly allied Crag Clathurellas are now found living in a few places as far north as the southern coasts of Sweden and Norway, they form, taken as a whole, a southern group of Mollusca, widely diffused in the Mediterranean and occurring on the southern and western shores of

Great Britain rather than on the east. Prof. Brøgger has pointed out that a few of them, as, for example, *C. purpurea* and *C. Leufroyi*, occur in certain zones of the later Pleistocene deposits of the Christiania region, viz., in those he has called the Tapes-banks, the Isocardia-clays and the Scrobicularia-clays, associated with other characteristic Lusitanian shells, and Dr. Øyen has found similar species near Trondhjem in strata of like age,[1] indicating the existence of a milder climate at a certain stage of the post-glacial period than that of the present day in the same region. The colonies of such southern species now found living far to the north of their general habitat may be probably survivors of this immigration which appears to have taken place subsequently to the final melting of the great ice-sheets.

The existence of this group of southern shells in the Waltonian Crag, moreover, supports the view already taken that there is a closer connection between it and the Coralline Crag with its strong Mediterranean affinities than has been hitherto suspected. They are fairly abundant in the Waltonian deposits. I have in my own collection from Oakley, for example, more than fifty specimens of the most characteristic species, but have no reason to think they are equally abundant at the later horizons of the Red Crag.

C. purpurea was not recorded by Wood as a Crag shell, though, judging from his figure of *Clavatula Philberti* (*op. cit.*), the specimen described by him under that name seems to belong to the former species; it has, as he remarked, the strong internal denticulation of the outer lip, and it presents the regular and wavy spiral sculpture and clathrate ornamentation distinctive of *C. purpurea*.[2] I have a specimen of a small variety, described below as var. *minor*, and one or two others not sufficiently perfect for illustration, from Oakley. As it has been reported from time to time from the Crag, it seems desirable to figure a Recent shell from St. Malo which may be regarded as typical, and may be useful to collectors for the purpose of comparison.

C. purpurea was found by Mr. A. Bell in a collection of Upper Pliocene shells from Biot near Antibes sent him for identification. It occurs also, according to Sign. Cerulli-Irelli, in the Upper Pliocene (Astiano) of Monte Mario, and is recorded by Bellardi from deposits of similar age in Northern Italy. It was met with in a Holocene deposit at Portrush in Antrim, discovered by the late James Smith of Jordanhill and afterwards described by Mr. A. Bell in the Report of the Leeds meeting of the British Association for 1890, p. 419.

---

[1] Øyen, Kgl. Norske Vid. Selsk. Skrift. [9], p. 148, 1910.

[2] The specimen of *C. purpurea* from Oakley (fig. 16) has the outer lip too imperfect to show the internal denticulation. The form and sculpture, however, are those of the present species.

Var. **minor**, Monterosato. Plate XXVIII, figs. 18, 19.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution.—Recent: Mediterranean.

Fossil: Coralline Crag: Sutton. Waltonian: Little Oakley.

Remarks.—The variety of *C. purpurea* here figured seems to agree with the type form except in size. It agrees with a Recent shell figured with it which I received from M. Dautzenberg under the above name.

Clathurella Philberti (Michaud). Plate XXVIII, figs. 20, 21.

1829. *Pleurotoma Philberti*, Michaud, Bull. Soc. Linn. Bordeaux, vol. iii, p. 261, pl. iii, figs. 2, 3.
1836–44. *Pleurotoma variegatum*, Philippi, Enum. Moll. Siciliæ, vol. i, p. 197, pl. xi, fig. 14, 1836; *P. Philberti*, vol. ii, p. 165, 1844.
1867. *Defrancia purpurea*, var. *Philberti*, Jeffreys, Brit. Conch., vol. iv, p. 370.
1873. *Defrancia purpurea*, var. *Philberti*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 127.
1877. *Homotoma Philberti*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 273.
1883. *Clathurella purpurea*, var. *Philberti*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Roussillon, vol. i, p. 91, pl. xiv, figs. 13–17.
1890. *Homotoma Philberti*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 281, no. 4287.
1890. *Clathurella Philberti*, Carus, Prod. Faun. Medit., vol. ii, p. 425.
1905. *Clathurella* (*Philbertia*) *Philberti*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 360, pl. xcv, figs. 24, 25; pl. xcvi, figs. 11, 12.

Specific Characters.—Shell fusiform, turreted, smaller and more slender than the type form of *C. purpurea;* whorls 8, slightly convex; ornamented by numerous longitudinal and transverse ridges, about equal in size, giving the shell a reticulate appearance; suture fairly deep; mouth ovate, narrow; outer lip grooved within, not thickened and toothed internally as in *C. purpurea*; canal distinct, short.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution.—Recent: West European, generally diffused in the Mediterranean and Ægean.

Fossil: Waltonian Crag: Little Oakley.

Upper Pliocene: Italy (Sacco). Pleistocene: Sicily—Messina, Ficarazzi.

Remarks.—This form has been variously regarded as a distinct species and as a variety of *C. purpurea*, to which it is closely allied.

M. Dautzenberg has kindly sent me some Recent specimens of this shell from the Mediterranean, one of which I figure for the guidance of future collectors, together with another from Oakley, which although not quite perfect, appears to correspond with it. I hope something better may turn up hereafter.

Hörnes gives *C. Philberti* from the Miocene beds of the Vienna basin (Foss. Moll. Tert. Wien, vol. i, p. 372, pl. xl, fig. 17), but as he makes no mention of *C. pur-*

purea, it is possible his figure may represent the latter species, the strong internal denticulation of the outer lip, which is hardly that of *C. Philberti*, pointing in that direction. In Italy the type form of the present species is only reported as fossil from the Upper Pliocene and the Pleistocene. Whether it should be regarded also as a Miocene species I must leave to those who have a more intimate knowledge of those deposits than I have.

Clathurella Leufroyi (Michaud). Plate XXVIII, figs. 13—15.

1828. *Pleurotoma Leufroyi*, Michaud, Bull. Soc. Linn. Bordeaux, vol. ii, p. 121, pl. i, figs. 5, 6.
1836–44. *Pleurotoma inflata*, Philippi, Enum. Moll. Siciliæ, vol. i, p. 197, pl. xi, fig. 24, 1836; *P. Leufroyi*, vol. ii, p. 165, 1844.
1848–72. *Pleurotoma Boothii*, S. V. Wood, Mon. Crag Moll., pt. i, p. 63, pl. vii, fig. 16, 1848; *P. Leufroyi*, 1st Suppl., pt. i, p. 206, 1872.
1853. *Mangelia Leufroyi*, Forbes and Hanley, Brit. Moll., vol. iii, p. 468, pl. cxiii, figs. 6, 7.
1867. *Defrancia Leufroyi*, Jeffreys, Brit. Conch., vol. iv, p. 366, pl. lxxxix, fig. 1.
1870. *Defrancia Leufroyi*, A. Bell, Journ. de Conch., vol. xviii, p. 348, no. 292.
1873–5. *Defrancia Leufroyi*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 124, 1873; vol. v, p. 276, no. 41, 1874; vol. vi, p. 208, no. 195, 1875.
1877. *Homotoma Leufroyi*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 274.
1883. *Clathurella Leufroyi*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 95, pl. xiv, figs. 3, 4.
1890. *Clathurella Leufroyi*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 281, no. 4290.
1890. *Clathurella Leufroyi*, Carus, Prod. Faun. Medit., vol. ii, p. 427.
1901. *Clathurella Leufroyi*, Brøgger, Norges Geol. undersøgelse, vol. xxxi, p. 662.
1905. *Clathurella* (*Leufroyia*) *Leufroyi*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 365, pl. xcvi, figs. 4, 5.
1910. *Peratotoma* (*Leufroyia*) *Leufroyi*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 59, pl. v, fig. 46.
1912. *Pleurotoma Leufroyi*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 90, no. 221.
1914. *Peratotoma* (*Leufroyia*) *Leufroyi*, Cipolla, Palaeont. Ital., vol. xx, p. 174, pl. xiv, fig. 24.

Specific Characters.—Shell fusiform, turreted, fairly solid; whorls 7—8, convex, the last inflated, much the largest, three-fourths the total length; ornamented by strong but not very prominent longitudinal ribs, 18—20 on the body-whorl, curved in correspondence with the lines of growth, and by numerous closely set spiral ridges, alternately smaller towards the base, which cross the ribs and become finely granulate where they intersect them; suture deep; spire short, rapidly diminishing in size; mouth oval, angulate above; labial notch small but well-marked, close to the suture, outer lip bevelled off to a thin edge, smooth inside; canal very short, rather wide.

Dimensions.—L. 17—20 mm. B. 7—9 mm.

Distribution.—*Recent:* southern and western coasts of Great Britain and Ireland, but ranging as far north as the Orkneys and Shetlands. Bergen, Bohuslan. West

European from Gibraltar to Brittany. All parts of the Mediterranean, Adriatic, and Ægean. Canaries.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley. Newbournian: Sutton. Butleyan: Butley (A. Bell). Pleistocene: Wick. Scaldisien: Holland.

Upper Pliocene: France—Biot; Italy—Válle Andona, Colle Astesi, Monte Mario, Bologna; Sicily—Altavilla, Messina.

Pleistocene: Italy—Taranto, Livorno, Válle Biaia, Calabria; Sicily—Monte Pellegrino, Ficarazzi, Messina, Catania.

Isocardia- and Tapes-banks: Christiania (Brøgger), Trondhjem (Øyen).

Remarks.—C. Leufroyi may be distinguished from *C. purpurea* by its stronger and less numerous costæ, its finer and less regular spiral sculpture, its more tumid whorls, its expanded mouth, and especially by the absence of marked denticulation on the interior of the outer lip. It never presents the distinct and regularly clathrate appearance of the former species.

It has not been recorded from the Coralline Crag, but Wood gives it from Walton, and I have obtained a dozen specimens from Oakley, most of them more or less imperfect.

Bellardi reports it from the Astian deposits of Northern Italy, Sign. Cerulli-Irelli from beds of similar age at Monte Mario, and Seguenza from all the fossiliferous horizons of Sicily.

It can hardly be called a common British species, but with other Clathurellas is widely diffused and more or less abundant in the Mediterranean. As before stated it occurs with other Lusitanian shells at certain post-glacial zones of the Christiania and Trondhjem regions.

Clathurella concinna (Scacchi). Plate XXVIII, figs. 22, 23.

1836. *Pleurotoma concinna*, Scacchi, Cat. Conch. Regn. Neap., p. 12, fig. 18.
1867. *Defrancia Leufroyi* (pars), Jeffreys, Brit. Conch., vol. iv, p. 368.
1882. *Clathurella concinna*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Roussillon, vol. i, p. 98, pl. xiv, fig. 5.
1890. *Clathurella concinna*, Carus, Prod. Faun. Medit., vol. ii, p. 428.
1905. *Clathurella* (*Cyrillia*) *linearis concinna*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 368, pl. xcvi, figs. 6, 7.
1910. *Peratotoma* (*Leufroyia*) *concinna*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 60, pl. v, fig. 47.
1914. *Peratotoma* (*Leufroyia*) *concinna*, Cipolla, Palaeont. Ital., vol. xx, p. 175, pl. xiv, figs. 25, 26.

Specific Characters.—Shell small, solid, ovato-fusiform; spire short, turriculate; whorls convex, the last much the largest, three-fourths the total length; ornamented by strong, rounded, longitudinal ribs, and by fine, thread-like, spiral ridges

which cross the ribs; suture fairly deep; mouth oval with a small angulate notch above; outer lip thickened by the labial rib, smooth within; canal short and open.

Dimensions.—L. 10—12 mm. B. 5—6 mm.

Distribution.—*Recent:* Mediterranean, Adriatic.

Fossil: Waltonian Crag: Little Oakley.

Upper Pliocene: Italy—Monte Mario; Sicily—Altavilla. Pleistocene: Tunis.

Remarks.—This form, regarded by M.M. Dautzenberg, Dollfus, the Marchese di Monterosato and others as a distinct species, was held by Jeffreys (*op. cit.*) to be identical with *C. Leufroyi*. I follow the authorities named in separating it from the latter. My Crag fossil has been identified by M. Dautzenberg, who has kindly sent me a Recent specimen from the Mediterranean for comparison. Prof. Kobelt, on the contrary, regards *C. concinna* as a variety of *C. linearis*. The former has not been recorded from British seas.

Clathurella linearis (Montagu). Plate XXVIII, figs. 26—29.

1803. *Murex linearis*, Montagu, Test. Brit., pt. i, p. 261, pl. ix, fig. 4.
1803. *Murex elegans*, Donovan, Brit. Shells, vol. v. pl. clxxix, fig. 3.
1848. *Pleurotoma linearis*, S. V. Wood, Mon. Crag Moll., pt. i, p. 56, pl. vii, fig. 2.
1853. *Mangelia linearis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 470, pl. cxiv, figs. 1—3.
1867. *Defrancia linearis*, Jeffreys, Brit. Conch., vol. iv, p. 368, pl. lxxxix, fig. 2.
1873–5. *Defrancia linearis*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 125, 1873; vol. v, p. 276, no. 42, 1874; vol. vi, p. 208, no. 187, 1875.
1877. *Homotoma elegans*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 271.
1878. *Clathurella linearis*, G. O. Sars, Moll. Reg. Arct. Norv., p. 218, pl. xxiii, fig. 2.
1883. *Clathurella linearis*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 96, pl. xiv, figs. 20, 21.
1890. *Clathurella linearis*, Carus, Prod. Faun. Medit., vol. ii, p. 426.
1901. *Clathurella linearis*, Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 661, pl. xvii, fig. 15; pl. xviii, fig. 18.
1905. *Clathurella* (*Cirillia*) *linearis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 367, pl. xcvi, figs. 13—15.
1910. *Peratotoma* (*Cirillia*) *linearis*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 59, pl. v, figs. 39—45.

Specific Characters.—Shell small, solid in the type form; whorls convex, the last much the largest, three-fifths the total length, ornamented by strong, thick and prominent longitudinal ribs, granulated and equal to the spaces between them, ten to twelve on the body-whorl, and by thread-like and regular spiral lines; suture deep; mouth pyriform; canal short, open, turning to the left; outer lip thick, crenellated by the spiral ridges; inner lip slight and retired; pillar flexuous.

Dimensions.—L. 8 mm. B. 4 mm.

Distribution.—*Recent:* generally distributed on the southern coasts of Great Britain, less frequently on the northern. North Atlantic from Iceland and Finmark to Madeira and the Canaries. Mediterranean, Adriatic, Ægean.

Fossil : Coralline Crag: Sutton, Boyton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Waldringfield, Sutton. Butleyan: Butley. Icenian: Bramerton, Aldeby. St. Erth.

Pleistocene: Billockby, March gravels, Selsey, Portland. Holocene: Portrush.

Lower Pliocene: Italy—Zinola near Savona (Bellardi).

Upper Pliocene: Italy—Astiano, Bologna. Sicily—Altavilla. France—Normandy, Biot.

Pleistocene: Isocardia- and Tapes-banks—Christiania, Trondhjem (Øyen); Italy—Reggio, Gravina, Livorno, Válle Biaia; Sicily—Monte Pellegrino, Messina.

Remarks.—We have in the English Crag the three varieties of *C. linearis* figured by Forbes and Hanley (*op. cit.*)—one the typical British and southern shell, solid and strongly sculptured (Pl. XXVIII, figs. 26, 27), the others less solid and more finely sculptured, generally regarded as northern, viz. var. *intermedia* (fig. 28) with blunt and more numerous ribs and rounded whorls, and var. *pallida* (fig. 29), slender, delicately sculptured, with a more elongate spire. These varieties correspond more or less nearly with the Recent Norwegian shell of Prof. G. O. Sars (*op. cit.*), and the Pleistocene fossils of Prof. Brøgger from Christiania, (*op. cit.*) and of Dr. Øyen from Trondhjem. I have found the typical form from the comparatively southern Crag of Oakley; the varieties *intermedia* and *pallida* are not infrequently met with in the later and more boreal deposits of Butley.

Var. **æqualis** (Jeffreys). Plate XXX, fig. 39.[1]

1842. *Pleurotoma ? lineare*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 542.
1848. *Clavatula perpulchra*, S. V. Wood, Mon. Crag Moll., pt. i, p. 58, pl. vii, fig. 4.
1871. *Defrancia linearis*, var. *æqualis*, Jeffreys, Quart. Journ. Geol. Soc., vol. xxvii, p. 143.
1912. *Pleurotoma perpulchra*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 90, no. 227.

Varietal Characters.—Much smaller than the type, with more numerous and less prominent ribs, and finer spiral sculpture.

Dimensions.—L. 4 mm. B. 2 mm.

Distribution.—Recent : Donegal Bay (Norwich Museum).

Fossil : Coralline Crag: Sutton, Gomer (Jeffreys). Waltonian: Walton-on-Naze (Kendall). Scaldisien: Holland.

Remarks.—In 1848 (*op. cit.*) Wood described and figured a minute fossil, having obtained many examples of it from the bed of Coralline Crag at Sutton, which is principally composed of such small shells.[2] In his Catalogue of 1842 he had

[1] The artist has not been very successful with this specimen.

[2] Such beds of fine or coarse shells have no zonal value, indicating rather the local and temporary existence of currents of greater or less strength.

considered this form to be a dwarf variety of *C. linearis*, but afterwards regarded it as distinct, under the name of *Clavatula perpulchra*.

In 1871 (*op. cit.*), Jeffreys, agreeing with Wood's earlier opinion, called it *C. linearis* var. *æqualis*. Comparing our fossil with some minute specimens of that species in the Norwich Castle Museum, I think his identification was right.

It should be stated, however, that in his British Conchology (vol. iv, p. 369, 1867) he had adopted the same varietal name for the vars. *intermedia* and *pallida* of Forbes and Hanley (1853), merging them together without explanation. Against this Mr. J. T. Marshall has strongly protested (Journ. Conch., vol. xiii, p. 299, 1912), urging that the original names should stand. While I agree with this, I see no objection to the use of *æqualis* for the present form, to which it is clearly entitled.

Clathurella Cordieri (Payraudeau). Plate XXVIII, figs. 30, 31.

1814. *Murex echinatus*, Brocchi, Conch. foss. subap., vol. ii, p. 423, pl. viii, fig. 3.
1826. *Pleurotoma Cordieri*, Payraudeau, Moll. Corse, p. 144, pl. vii, fig. 11.
1844. *Pleurotoma reticulatum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 165.
1848. *Clavatula cancellata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 61, pl. vii, fig. 9.
1867. *Defrancia reticulata*, Jeffreys, Brit. Conch., vol. iv, p. 370, pl. lxxxix, fig. 3.
1873–5. *Defrancia reticulata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 126, 1873; vol. vi, p. 208, no. 188, 1875.
1883. *Clathurella Cordieri*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 92, pl. xiv, figs. 10, 11.
1890. *Clathurella Cordieri*, Carus, Prod. Faun. Medit., vol. ii, p. 424.
1905. *Clathurella (Cordieri) reticulata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 351, pl. xcv, figs. 13—16.
1910. *Peratotoma reticulata*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 57, pl. v, figs. 25—32.

Specific Characters.—Shell rather thin, fusiform; whorls convex, the last more than half the total length; ornamented by narrow lamelliform longitudinal ribs, and by spiral ridges which become prickly where they intersect them; spire turreted, more or less elongate; apex acute; suture deep; mouth oval; canal distinct, turning slightly to the left; outer lip curved, somewhat expanded; pillar nearly straight.

Dimensions.—L. 8—16 mm. B. 3—7 mm.

Distribution.—Recent: British coasts (principally on the west and south) and from Guernsey to Shetland.

Mediterranean, from Gibraltar to the Morea, widely diffused. Adriatic, Ægean, coasts of France, Spain, and Norway.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze. Newbournian: Bentley. Pleistocene: Selsey. Holocene: Portrush.

Miocene: Italy, North Germany. Lower Pliocene: Italy. Upper Pliocene: Italy—Monte Mario; Sicily. Pleistocene: Sicily, Calabria, Tuscany.

Remarks.—This species, the name of which has been often changed, is, like other Crag forms of *Clathurella*, a characteristic Mediterranean species, its origin going back to Miocene times. The specimen here figured is one I received from Mr. P. G. H. Boswell, who obtained it at Bentley. It seems to be a dwarf form, smaller and more slender than the type; although worn it appears to correspond with some Recent shells from Palermo which I received from the Marchese di Monterosato. The specimen figured by Wood as *Clavatula cancellata* may be a larger variety of the same species.

Clathurella hystrix (Jan). Plate XXVIII, figs. 24, 25.

1832. *Pleurotoma hystrix*, Jan, Cat. rer. nat. Mus. Crist. Jan, p. 10, no. 59.
1847. *Raphitoma hystrix*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 613, pl. iv, fig. 14.
1870. *Defrancia hystrix*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vi, p. 215.
1871. *Defrancia hystrix*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488.
1872. *Pleurotoma hystrix*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 41, pl. vi, fig. 3.
1873–5. *Defrancia hystrix*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 128, 1873; vol. vi, p. 208, no. 196, 1875.
1881. *Pleurotoma hystrix*, Nyst, Conch. Terr. Tert. Belg., p. 46, pl. iii, fig. 13.
1890. *Homotoma hystrix*, Sacco, Boll. Soc. Geol. Ital, vol. ix, p. 281, no. 4279.
1890. *Clathurella hystrix*, Carus, Prod. Faun. Medit., vol. ii, p. 424.
1905. *Clathurella (Cordieri) hystrix*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 357, pl. xcvi, fig. 20.
1910. *Peratotoma hystrix*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 56, pl. v, fig. 22—24.
1912. *Pleurotoma hystrix*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 90, no. 232.

Specific Characters.—Shell rather fragile, subfusiform, slender, elongate, turreted; whorls convex, angulated above, the last about half the total length, excavated below; ornamented by fine, numerous longitudinal and transverse ridges, acutely papillate or spiny where they intersect, which gives the shell a quadrately clathrate appearance; suture deep, channelled; mouth ovate, angulate above; canal rather short, not continuous with the outer lip.

Dimensions.—L. 14—20 mm. B. 5—8 mm.

Distribution.—Recent: Mediterranean—Provence, Sardinia, Naples, Sicily, Catania, Tunis; Madeira.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze, Little Oakley. Scaldisien: Belgium, Holland.

Lower Pliocene: Zinola. Upper Pliocene: Biot, Monte Mario, Bologna, Altavilla, Messina. Pleistocene: Messina, Monte Pellegrino, Ficarazzi.

Remarks.—This is another of the southern species, not known as living further north than the Mediterranean, which continued to exist in the Anglo-Belgian basin as late as the Waltonian period. Wood records it from the Coralline Crag and from Walton, and I have nearly twenty specimens in my collection from

Oakley. Some of them are fragmentary, but they are not worn, and being fragile cannot have been derivative at that locality. Jeffreys reports this species from the Coralline and Red Crags, Nyst and M. van den Broeck from the Scaldisien of Belgium and Dr. Tesch from that of Holland. It is said to be fairly common in the Upper Pliocene of northern Italy, and Mr. A. Bell has recorded it from the Upper Pliocene of Biot; it has been found also in Lower Pliocene deposits on the Italian Riviera. I am not aware that it has been met with in the English Crag at any horizon later than that of Oakley. My Oakley fossils are somewhat more slender and elongate than Wood's figure of this species.

Genus **BELLARDIELLA**, Fischer, 1883.

Bellardiella gracilis (Montagu). Plate XXVIII, figs. 34, 35.

1803. *Murex gracilis*, Montagu, Test. Brit., pt. i, p. 267, pl. xv, fig. 5.
1853. *Mangelia gracilis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 473, pl. cxiv, fig. 4.
1867. *Defrancia gracilis*, Jeffreys, Brit. Conch., vol. iv, p. 363, pl. lxxxviii, fig. 6.
1873–5. *Defrancia gracilis*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 123, 1873; vol. v, p. 276, no. 40, 1874; vol. vi, p. 208, no. 191, 1875.
1881. *Pleurotoma emarginata*, Nyst, Conch. Terr. Tert. Belg., p. 48, pl. iii, fig. 12.
1883. *Pleurotoma* (*Bellardia*) *gracile*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 88, pl. xiv, figs. 1, 2.
1890. *Clathurella emarginata*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 280, no. 4269.
1896. *Daphnella* (*Bellardiella*) *gracilis*, Cossmann, Ess. Paléoconch. comp., vol. ii, p. 128.
1904. *Bellardiella gracilis*, Sacco, Moll. Terr. Terz. Piem., pt. xxx, p. 53, pl. xiv, figs. 2, 3.
1905. *Bellardiella gracilis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 348, pl. xcv, figs. 9—12.
1910. *Daphnella* (*Bellardiella*) *gracilis*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 61, pl. x, figs. 50—53
1912. *Pleurotoma gracilis*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 90, no. 228.
1914. *Daphnella* (*Bellardiella*) *gracilis*, Cipolla, Palaeont. Ital., vol. xx, p. 153, pl. xiii, figs. 26—28.

Specific Characters.—Shell slender, fusiform, turreted; whorls 8—10, convex, ornamented by twelve or more strong longitudinal ribs, discontinuous at the suture and flexuous on the body-whorl, which do not reach the base of the shell, and by closely set and fine undulating spiral ridges; suture wide and rather deep; mouth oval; labial notch deep and well marked; canal wide, expanded below; outer lip thickened inside, with a sharp edge; pillar flexuous.

Dimensions.—L. 18 mm. B. 6 mm.

Distribution.—Recent: coasts of Great Britain and Ireland, principally south and west, from the Channel Islands to Shetland. Atlantic coast from Cherbourg to Gibraltar. Madeira, Canaries. Mediterranean, Adriatic, Ægean.

Fossil: Coralline Crag: Gomer pit. Newbournian: Waldringfield. Pleistocene clay: Belfast.

Scaldisien: Holland, Belgium.

Upper Miocene (Tortoniano): Castelnuovo d'Asti. Lower Pliocene: Castelnuovo d'Asti, Zinola, Albenga. Upper Pliocene: Biot, Monte Mario, Bologna, Asti, Livorno, Altavilla. Pleistocene: Monte Pellegrino, Reggio, Gravina, Naso.

Remarks.—Bellardiella, of which the present species has been taken as the type, was proposed by Fischer as a sub-genus of *Mangilia*, and this view has since been adopted by the Conchological Society of Great Britain. M. Cossmann and others group it with *Daphnella*, which, however, Fischer regards as a sub-genus of *Mangilia*. In view of this conflict of nomenclature I follow Profs. Sacco and Kobelt in using *Bellardiella* as the name of a separate genus. The use of the trinomial system is attended with considerable inconvenience, and I am glad of an excuse to escape from it in the present case. Fischer's diagnosis of *Bellardiella* is that it is a slender shell near the true Pleurotomas, the labial sinus being sutural and the canal moderately long.

B. gracilis is a British form, its range being mainly southern. It has not been reported hitherto from the English Pliocene, but I have noticed a specimen from the Coralline Crag, not quite perfect, in the Sedgwick Museum at Cambridge, and Mr. Bell informs me there is another in the Museum at Belfast which was found some years ago in the estuarine (Pleistocene) clays of that region by Mr. Stewart. I have not met with it at Oakley, but it may turn up hereafter in the Waltonian as it occurs, according to Nyst, in the Scaldisien of Belgium, and Dr. Tesch has obtained it at the same horizon in one of the Dutch borings. Bellardi gives it from the Miocene and Pliocene deposits of northern Italy under Donovan's name of *Murex emarginatus*. It is a well-marked form and easily recognised.

Bellardiella volutella (Kiener). Plate XXVIII, figs. 32, 33.

1840. *Pleurotoma volutella*, Kiener, Icon. Coq. viv. (Pleurotoma), p. 67, pl. xxv, fig. 1.
1844. *Pleurotoma volutella*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 165.
1873. *Defrancia volutella*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 122.
1910. *Daphnella* (*Bellardiella*) *volutella*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 62, pl. vi, figs. 1—4.

Specific Characters.—Shell small, fusiform, turreted; spire elongate, regularly diminishing in size; whorls 7, convex, the last about two-thirds the total length; ornamented by well-marked flexuous longitudinal costæ which reach the body-whorl but not the base of the shell, and by fine spiral lines which cross the ribs; mouth oval, angulated above, outer lip regularly curved, somewhat expanded, smooth inside with a thin edge but thickened outside by the labial rib; labial sinus inconspicuous; canal short, well defined.

Dimensions.—L. 12 mm. B. 5 mm.

Distribution.—Not known living.

Fossil : Coralline Crag : Boyton.

Upper Pliocene : Monte Mario. Pleistocene : Catania, Monte Pellegrino, Ficarazzi.

Remarks.—The charming little shell from the Coralline Crag of Boyton here figured belongs to the Sedgwick Museum at Cambridge, where it has been labelled *Clavatula linearis*. It proves to be identical, however, with a Sicilian fossil, *Bellardiella volutella*, a specimen of which the Marchese di Monterosato has been kind enough to send me for comparison. It has been recorded by Sign. Cerulli-Irelli from the Upper Pliocene of Monte Mario, and occurs at a number of places in the upper part of the Sicilian Pleistocene, as at Catania and at Monte Pellegrino and Ficarazzi, near Palermo, together with *Cyprina islandica* and other northern forms, an horizon which in the present Memoir I have regarded as more or less contemporaneous with the Pleistocene of northern Europe.

It is interesting to note that this shell has been met with at one locality only of the Crag, suggesting, with other similar facts, that in spite of the labours of a century we are still very far from possessing a full and exhaustive knowledge of the Crag mollusca.

The Marchese di Monterosato informs me that although the name of *C. volutella* sometimes appears in lists of the Recent mollusca of the Mediterranean it has never been met with, in his opinion, as a living shell, and that the specimen recorded as such by Kiener was washed in all probability by the sea from some adjacent fossiliferous deposit. The present species has sometimes been identified with *C. inflata*, Jan, but this he also thinks may have been an error.

Bellardiella stria (Calcara). Plate XXIX, figs. 1, 2.

1840. *Pleurotoma stria*, Calcara, Ricerche malac., p. 11, pl. i, fig. 5.
1844. *Pleurotoma semiplicatum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 174, pl. xxvi, fig. 18.
1847. *Raphitoma stria*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 618, no. 8.
1862. *Pleurotoma semiplicatum B*, var. *minus*, Brugnone, Mem. Pleur. foss. Palermo, p. 29, pl. i, fig. 22.
1873–5. *Defrancia stria*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 121, 1873; vol. vi, p. 208, no. 183, 1875.
1877. *Homotoma stria*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 277, pl. viii, fig. 25.
1910. *Daphnella* (*Bellardiella*) *stria*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 61, pl. v, figs. 54—57.
1914 *Daphnella* (*Bellardiella*) *stria*, Cipolla, Palaeont. Ital., vol. xx, p. 155, pl. xiv, figs. 1, 2.

Specific Characters.—Shell thin, turreted, elongato-fusiform, ventricose; whorls strongly convex, regularly diminishing in size, the last much the largest, two-thirds the total length ; ornamented by numerous oblique and inconspicuous longitudinal costæ, which tend to become flexuous and to die out on the body-whorl, and by very

fine thread-like lines in the interspaces, becoming more distinct and curving to the left at the suture, with a number of raised unequal spiral ridges which cross the ribs; suture deep and channelled; mouth oval, passing into a narrow canal; outer lip thin.

Dimensions.—L. 25 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Upper Pliocene: Biot, Monte Mario, Colle Astesi, Válle Andona, Bologna, Altavilla.

Pleistocene: Ficarazzi, Monte Pellegrino.

Remarks.—The fragmentary and probably immature fossil from Oakley described provisionally under the above name is different from anything I have met with elsewhere in the Crag. As far as it goes, it agrees with a specimen of *B. stria* from the Pleistocene deposits of Monte Pellegrino, near Palermo, that the Marchese di Monterosato has kindly sent me, which I figure with it as a guide to future collectors. It is a fragile shell and can hardly be derivative in the Oakley Crag.

Genus **MANGILIA**, Risso, 1826.

Mangilia costata (Donovan). Plate XXIX, fig. 13.

1803. *Murex costatus*, Donovan, Nat. Hist. Brit. Shells, vol. iii, p. 91.
1848. *Clavatula costata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 58, pl. vii, fig. 6.
1853. *Mangelia costata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 485, pl. cxiv A, figs. 3, 4.
1867. *Pleurotoma costata*, Jeffreys, Brit. Conch., vol. iv, p. 379, pl. xc, fig. 3.
1873–5. *Mangelia costata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 110, 1873; *Raphitoma costata*, vol. vi, p. 210, no. 226, 1875.
1890. *Mangilia costata*, Carus, Prod. Faun. Medit., vol. ii, p. 418.
1905. *Mangilia costata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 343, pl. xciv, figs. 18—20.
1910. *Mangilia costata*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 54, pl. v, fig. 10.
1912. *Pleurotoma costata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 88, no. 224.
1914. *Mangilia costata*, Cipolla, Palaeont. Ital., vol. xx, p. 141, pl. xiii, figs. 9, 10.

Specific Characters.—See S. V. Wood, Mon. Crag Moll., pt. i, p. 58.

Dimensions.—L. 8 mm. B. 3 mm.

Distribution.—Recent: British Seas, generally distributed. West European, Marseilles, Sicily.

Fossil: Coralline Crag: Sutton, Boyton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Foxhall, Waldringfield, Newbourn, Sutton, Felixstowe, Shottisham. Butleyan: Butley, Alderton. Wexford.

Pleistocene: Ireland—Belfast, Portrush; Scotland—Cumbrae, Largo Bay.

Scaldisien, Poederlien: Belgium. Scaldisien: Holland.

Upper Pliocene: Bologna, Orciano, Monte Mario, Altavilla.

Pleistocene: Livorno, Ficarazzi, Monte Pellegrino.

The generic name *Mangilia*[1] (formerly *Mangelia*) is now used for a group of small inoperculate Pleurotomidæ, longitudinally costated, with a thickened or varicose outer lip, a narrow mouth, a well-marked sinus, and a short canal.

Remarks.—The type form of this well-known British shell is fairly common in the Coralline, and not very rare in the Red Crag, as at Oakley, where, however, it is not nearly so abundant as *Raphitoma mitrula*. It seems to be the southern variety of the present species; the variety *coarctata*, described below, being more characteristic of northern regions.

Var. **coarctata** (Forbes). Plate XXIX, fig. 14.

1840. *Pleurotoma coarctata*, Forbes, Mag. Nat. Hist., vol. v, p. 107, pl. ii, fig. 15.
1853. *Mangelia costata*, var. *coarctata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 486, pl. cxiv A, fig. 5.
1867. *Pleurotoma costata*, var. *coarctata*, Jeffreys, Brit. Conch., vol. iv, p. 380.
1901. *Mangilia costata*, var. *coarctata*, Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 662, pl. xviii, fig. 19.
1905. *Mangilia costata coarctata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 344, pl. xciv, figs. 21—23.
1910. *Mangilia costata*, var. *coarctata*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 54, pl. v, fig. 12.
1914. *Mangilia costata*, var. *coarctata*, Cipolla, Palaeont. Ital., vol. xx, p. 142, pl. xiii, fig. 11.

Varietal Characters.—More slender than the type; spire elongate; mouth narrow, lanceolate.

Dimensions.—L. 10—12 mm. B. 3 mm.

Distribution.—*Recent:* British and Scandinavian seas. Palermo (Monterosato).

Fossil: Waltonian Crag: Walton-on-Naze, Beaumont, Little Oakley. Butleyan: Butley; no doubt elsewhere in the Red Crag. St. Erth.

Upper Pliocene: Monte Mario, Altavilla.

Pleistocene: Isocardia- and Tapes-banks of Christiania and Trondhjem (Øyen); Ficarazzi.

Remarks.—This well-known variety, originally described by Forbes as specifically distinct, seems, as just stated, to be characteristic of northern seas, the type having generally a more southern range. The Marchese di Monterosato, however, has taken it as a Recent shell at Palermo. Prof. Kendall informs me he found the present variety as well as the type form to be rather common at Walton, and I have a fair number of each in my collection from Oakley. Probably some of those

[1] Named after the naturalist Mangili.

Distribution.—Recent: Mediterranean. Ægean.

Fossil: Waltonian Crag: Little Oakley.

Remarks.—The unworn but imperfect fossil here given as *M. albida* corresponds very nearly with the Recent shell figured by Prof. Kobelt under this name, and may be referred provisionally, I think, to it. Our specimen appears to be distinct from anything else known to me from the Crag and deserves notice. I hope a more complete example may turn up hereafter. Dr. Bucquoy and his colleagues group a number of allied forms as varieties of the present species.

Mangilia Smithii (Forbes). Plate XXIX, figs. 21, 22.

1840. *Pleurotoma Smithii*, Forbes, Ann. Mag. Nat. Hist., vol. v, p. 107, pl. ii, fig. 14.
1846. *Pleurotoma striolata*, Reeve, Conch. Icon., vol. i (Pleurotoma), pl. xxxv, fig. 320.
1853. *Mangelia striolata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 483, pl. cxiv A, figs. 1, 2.
1867. *Pleurotoma striolata*, Jeffreys, Brit. Conch., vol. iv, p. 376, pl. xc, fig. 1.
1871. *Pleurotoma striolata*, Jeffreys, Quart. Journ. Geol. Soc., vol. xxvii, p. 490.
1873. *Mangelia striolata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 113.
1890. *Raphitoma costulatum*, var. *striolata*, Carus, Prod. Faun. Medit., vol. ii, p. 422.
1905. *Raphitoma (Smithiella) costulatum striolatum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 383, pl. xcvii, fig. 20.

Specific Characters.—Shell fusiform, slender, rather solid; spire turreted, elongate, regularly tapering; whorls 7, but slightly convex, squarely shouldered above, the last more than half the total length; ornamented by nine or ten prominent longitudinal costæ, and by excessively fine spiral lines, only visible by the aid of a lens; suture deep; mouth narrow, contracted above, showing clearly a small and shallow labial notch; outer lip slightly thickened outside by the labial rib, not expanded; columella flexuous.

Dimensions.—L. 10—12 mm. B. 4 mm.

Distribution.—Recent: British seas, western and southern. Western coasts of France, Spain and Portugal. Mediterranean, Adriatic, Madeira, Canary Isles.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley, Beaumont. Newbournian: Sutton (Jeffreys).

Pleistocene: Monte Pellegrino, Catania, Gravina, Reggio, Válle Biaia.

Remarks.—The Recent British and Mediterranean species generally known as *Pleurotoma*, *Raphitoma* or *Mangelia striolata*, which, for the reasons given below, I am describing under Forbes' varietal name of *Smithii*, seems to have been a rather rare denizen of the Crag sea. I have met with several specimens of it at Oakley, and Jeffreys reported it from the Red Crag of Sutton. Seguenza gives *Mangelia striolata*, Scacchi, from various localities of the Italian and Sicilian Pleistocene, and this may possibly be the same as the present form, which otherwise has not been recognized from the Pliocene of the south of Europe.

In 1826 Risso described and clearly figured a shell as *Mangelia striolata*,[1] and Prof. Kobelt has lately reproduced his drawing (*op. cit.*, pl. xcvi, fig. 25) under the same name. It is a true *Mangilia*, differing, as far as I know, from anything else either Recent or fossil. Everyone admits that Risso's *M. striolata* has nothing to do with the Recent form now known under that name.

Ten years later, in 1836, Scacchi introduced the name *Pleurotoma* (*Mangelia*) *striolata* into his list of Neapolitan mollusca,[2] identifying it with Risso's shell. It has been generally assumed it was different, and that it was the prototype of the Recent *M. striolata* referred to. It seems impossible to ascertain, however, what Scacchi's species really was. The only direct evidence we have is that its author thought it to be the same as that of Risso.

For the purpose of our present inquiry the point is not material. If Scacchi's shell was identical with Risso's, it had nothing to do with our Recent species; if not, the latter has no right to be called *M. striolata*, that name having been previously used for a different form, viz., for Risso's, still less can it be handed on to anything else.[3]

The first unquestioned notice of the present shell was that of Ed. Forbes, who in 1840 described and figured it as *Pleurotoma Smithii*,[4] but afterwards, in 1853, in the British Mollusca, Forbes and Hanley, admitting it to be a *Mangilia*, dropped that name in favour of *M. striolata*, Scacchi,[5] Reeve having meanwhile figured it under the latter name.[6]

In 1844 Philippi described an entirely different species[7] under Scacchi's specific term *striolata*. We appear to have the same form in the Crag (see p. 270). It was, however, a *Raphitoma*, not a *Mangilia*.

Prof. Kobelt gets over the difficulty by regarding the Recent shell as a *Raphitoma*, figuring it side by side with a reproduction of Philippi's drawing, and using Philippi's specific name of *striolata* for both of them. I prefer, however, to follow Forbes and Hanley, M. Dollfus, and others in describing the former as a *Mangilia*, under the only name to which it is entitled, viz. *M. Smithii*. Philippi's name *P. striolata* can hardly be applied to the *Raphitoma* figured by him and to the Crag forms which appear to represent it, as it had been previously used for something different. I am describing these shells below as *Raphitoma striatula*.

I have dealt with this matter at considerable length, not only because of its importance but also because the best way of dispelling the confusion which surrounds it seems to be to state the facts as fully but as briefly as I can.

[1] Hist. Nat. Eur. merid., vol. iv, p. 221, pl. viii, fig. 101, 1826.

[2] Cat. Conch. Regn. Neap., p. 13, 1836.

[3] I assume that our shell is a *Mangilia*, as M. Dollfus and others think.

[4] *Op. cit.*, p. 107, pl. ii, fig. 14, 1840.

[5] *Op. cit.*, p. 483, pl. cxiv A, figs. 1, 2, 1853.

[6] *Op. cit.*, pl. xxxv, p. 320, 1846.

[7] Enum. Moll. Siciliæ, vol. ii, p. 168, pl. xxvi, fig. 7, 1844.

Mangilia indistincta, Monterosato. Plate XXIX, figs. 19, 20.

1869. *Mangelia cœrulans*, var., Appelius, Boll. malac. ital., vol. ii, p. 137, pl. iv, fig. 1.
1875. *Mangelia indistincta*, Monterosato, Nuova Riv. Conch. Medit., p. 43.
1884. *Mangelia indistincta*, Monterosato, Nomen. gen. spec. Conch. Medit., p. 129.
1905. *Mangelia indistincta*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 342, pl. xciv, figs. 13, 14.
1910. *Mangilia indistincta*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 52, pl. v, fig. 3.

Specific Characters.—Shell solid, ovato-fusiform; whorls 7—8, slightly convex, not angulated above, the last much the largest, two-thirds the total length; ornamented by strong longitudinal costæ, narrower than the intervening spaces, reaching the suture and the base of the shell; suture fairly deep; outer lip thickened outside by the labial rib; mouth oval, with a well-marked labial sinus, passing without break into a short canal.

Dimensions.—L. 10—12 mm. B. 4—5 mm.

Distribution.—*Recent:* Tyrrhenian Sea, Sicily, Sardinia, Corsica, Prévésa.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley.

Upper Pliocene: Monte Mario.

Remarks.—The fossil represented under this name is one of half a dozen I have found at Oakley corresponding more or less nearly with a Recent specimen of *Mangilia indistincta* belonging to Mr. Tomlin, which he received from the Marchese di Monterosato and has kindly allowed me to figure. Some of the Oakley shells approach to some extent the form I have taken as the Crag representative of *M. Smithii*, but the body-whorl of the latter is wider and is not angulated above. Prof. Kobelt, describing *M. indistincta*, says the last whorl is more inflated than in *M. cœrulans*, of which Appelius originally regarded it as a variety.

Mangilia ambigua (Brugnone). Plate XXIX, figs. 17, 18.

1862. *Pleurotoma ambiguum*, Brugnone, Mem. Pleur. foss. Palermo, p. 40, fig. 31.
1875. *Raphitoma ambigua*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 210, no. 227.
1877. *Mangelia ambigua*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 289, pl. viii, fig. 33.
1889. *Mangelia ambigua*, Sacco, Boll. Soc. Ital. Geol., vol. ix, p. 282, no. 4306.
1896. *Mangilia ambigua*, Cossmann, Ess. Paléoconch. Comp., vol. ii, p. 119.
1914. *Mangilia ambigua*, Cipolla, Palaeont. Ital., vol. xx, p. 137, pl. xiii, fig. 5.

Specific Characters.—Shell small, fusiform, fairly solid, turreted, slender; whorls 7 or 8, somewhat convex, regularly decreasing in size, the last slightly more than half the total length; ornamented by eight or nine strong, clearly sculptured

flexuous ribs which reach the suture and nearly to the base, but not to the two first whorls, which are smooth and polished; also by excessively fine spiral lines, hardly visible without the aid of a lens; suture well-marked; mouth oval, narrow, angulated above, continuous with a short and open canal; labial notch distinct, but not so large as in some other of the allied species; outer lip thickened by the labial rib.

Dimensions.—L. 10—12 mm. B. 3 mm.

Distribution.—Not recorded living.

Fossil : Waltonian Crag : Little Oakley.

Upper Pliocene : Sicily—Altavilla ; Northern Italy—Astiano.

Remarks.—I have obtained half a dozen examples of a charming little shell at Oakley, which, among the many hundred Pleurotomidiæ I have collected at that place, seem to separate themselves clearly from the rest.

The only thing I can find to which they may be referred is a species described by the Abbé Brugnone in 1862 from the Upper Pliocene deposits of Altavilla near Palermo; of this the Marchese di Monterosato has been kind enough to send me some specimens, one of which I have figured for comparison with a fossil from the Crag.

In its general appearance *M. ambigua* is not unlike some other of *Mangilia* here described, but it is regarded by Italian conchologists as distinct; indeed, it was formerly grouped with *Raphitoma*, Sign. Cipolla remarking that it appears to be an intermediate form, uniting these two genera.

Genus **HAEDROPLEURA**, Monterosato, 1882.

Haedropleura septangularis (Montagu). Plate XXVII, fig. 27; Plate XXIX, figs. 3, 4.

1803. *Murex septangularis*, Montagu, Test. Brit., pt. i, p. 268, pl. ix, fig. 5.
1844. *Pleurotoma septangulare*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 169.
1853. *Mangelia* (*Bela*) *septangularis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 458, pl. cxii, figs. 6, 7.
1865. *Pleurotoma septangularis*, C. B. Rose, Geol. Mag., vol. ii, p. 11.
1867. *Pleurotoma septangularis*, Jeffreys, Brit. Conch., vol. iv, p. 390, pl. xci, fig. 5.
1872. *Pleurotoma septangularis*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 38, pl. vi, fig. 16.
1873–5. *Bela septangularis*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 109, 1873; vol. vi, p. 206, no. 173, 1875.
1877. *Bela septangularis*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 147.
1883. *Haedropleura septangularis*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 110, pl. xiv, figs. 26, 27.
1890. *Haedropleura septangularis*, Carus, Prod. Faun. Medit., vol. ii, p. 414.
1893. *Pleurotoma septangularis*, A. Bell, Ann. Rep. Yorks. Phil. Soc., p. 64.

1905. *Haedropleura septangularis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 326, pl. lxxx, figs. 18, 19.

1910. *Bela* (*Haedropleura*) *septangularis*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 51, pl. iv, figs. 55–57.

Specific Characters.—Shell thick and solid, oblongo-fusiform; whorls 8—9, moderately convex, compressed towards the base, the last three-fifths the total length; spire regularly diminishing in size; apex blunt; ornamented by seven or eight strong and prominent longitudinal ribs with concave spaces between them, flexuous on the body-whorl, nearly straight on the upper whorls where they generally form a continuous series on the spire, together with excessively minute spiral striæ, the outer crust of the shell showing these striæ being generally more or less removed, especially in the Crag fossils; suture slight; mouth oblong, acutely angulate above; outer lip generally thickened by the labial rib; labial notch inconspicuous; canal short, wide and open; pillar curved in the middle.

Dimensions (of Crag specimens).—L. 10—12 mm. B. 3—4 mm.

Distribution.—Recent: Mediterranean, Adriatic, Ægean. Western coasts of France, Spain, and Portugal. British coasts, southern and western. Ireland. Bergen (Sars).

Fossil: Waltonian Crag: Little Oakley. Newbournian: Waldringfield. Butleyan: Butley. Pleistocene: Selsey (A. Bell), Nar Valley (Rose); Cumbræ, Largo Bay, Belfast. Holocene: Portrush.

Lower Pliocene: Italy—Vezza, near Alba. Upper Pliocene: Colle Astesi, Monte Mario, Altavilla. Pleistocene: Messina, Monte Pellegrino, Ficarazzi, Gravina, Válle Biaia.

Remarks.—The genus *Haedropleura* was proposed in 1882 by the Marchese di Monterosato for some small operculated Pleurotomas which had been included with the Belas, but differed materially from them in form and sculpture, a classification which has been adopted by Messrs. Dollfus and Dautzenberg, and other conchologists. The use of the generic term *Bela* is now generally confined to the well-known group of northern shells, of which *B. turricula* has been taken as the type.

The present rather variable but distinct form is a British shell, found only in Ireland and on the southern and western coasts of Great Britain, and having generally a southern range. It has not been recorded hitherto from the Crag, although it was found many years ago by the late C. B. Rose in the Nar Valley brick-earth (Pleistocene) at Pentney, about 8 miles S.E. of King's Lynn, and by Mr. A. Bell at Selsey. I have obtained half a dozen examples from Oakley, however, some of them nearly approaching those which occur in the *argiles bleues* (Lower Pliocene) of the Ligurian coast. Another from Waldringfield (Pl. XXVII, fig. 27), which is rather different, agrees with some Recent specimens from Brixham in the Holmes Collection at the Norwich Castle Museum.

Var. **secalina** (Philippi). Plate XXIX, figs. 5, 6.

1844. *Pleurotoma secalinum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 170, pl. xxvi, fig. 9.
1872. *Pleurotoma septangularis*, var., Monterosato, Notiz. Conch. foss. Mte Pellegrino e Ficarazzi, p. 34.
1873–5. *Bela secalina*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 108, 1873; *B. septangularis*, var. *secalina*, vol. vi, p. 206, no. 173, 1875.
1877. *Bela septangularis*, var. *A*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 148.
1883. *Haedropleura septangularis*, var. *secalina*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 111.
1884. *Haedropleura secalina*, Monterosato, Nom. gen. spec. Conch. Medit., p. 126.
1905. *Haedropleura septangularis secalina*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 327, pl. lxxx, figs. 20, 21.

Varietal Characters.—Smaller and more delicately sculptured than the type, the longitudinal costæ being finer and more numerous; the spire is generally shorter, and the mouth narrower and longer in proportion.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution. — *Recent:* Mediterranean — Naples, Taranto (Monterosato). Madeira and the Canaries (M'Andrew).

Fossil: Waltonian Crag: Little Oakley.

Upper Miocene: Stazzano (Bellardi). Lower Pliocene: Savona. Upper Pliocene: Biot, Altavilla. Pleistocene: Válle Biaia, near Pisa.

Remarks.—The present shell appears to be a southern form, unrecorded, as far as I know, from British seas. I have found several well-marked specimens at Oakley, associated with the type form of *H. septangularis*. It was originally described by Philippi as distinct, but has been regarded by later writers as a variety of the latter species. The Marchese di Monterosato, however, still considers it worthy of specific rank. Neither *H. septangularis* nor the present variety has been previously reported from the Crag.

A somewhat similar shell, from the Miocene of Northern Italy, has been identified by Prof. Sacco with the var. *A* of Bellardi.

Haedropleura rufa (Montagu). Plate XXIX, figs. 7, 8.

1803. *Murex rufus*, Montagu, Test. Brit., pt. i, p. 263.
1846. *Pleurotoma rufa*, Forbes, Mem. Geol. Surv., vol. i, p. 426.
1853. *Mangelia* (*Bela*) *rufa*, Forbes and Hanley, Brit. Moll, vol. iii, p. 454, pl. cxii, figs. 3, 4.
1864. *Bela rufa*, S. P. Woodward in White's Hist. of Norfolk, ed. 3, p. 117.
1867. *Pleurotoma rufa*, Jeffreys, Brit. Conch., vol. iv, p. 392, pl. xci, fig. 6.
1872. *Pleurotoma rufa*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 44, tab. vii, fig. 17.
1873. *Bela rufa*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 107.

1890. *Haedropleura rufa*, Carus, Prod. Faun. Medit., vol. ii, p. 415.
1905. *Haedropleura rufa*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 328, pl. lxxx, figs. 16, 17.

Specific Characters.—Shell short, oblongo-fusiform, fairly solid; spire turreted, gradually tapering; apex twisted; whorls slightly convex, the last three-fifths the total length; suture rather deep; ornamented by strong, flexuous longitudinal ribs, which do not reach the base of the shell, and by fine spiral lines; mouth irregularly oblong, continuous with a very short, open canal, notched at the end; outer lip thin, rounded; inner lip somewhat expanded; pillar flexuous.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution.—Recent: British coasts, eastern, southern and western. Ireland. West of Scotland. Western coast of France, Mediterranean, Provence. North-eastern America.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley. Butleyan: Butley (A. Bell). Icenian: Thorpe, near Norwich. Wexford gravels. Isle of Man.

Pleistocene: March gravels, Bridlington, Belfast; Sicily—Monte Pellegrino, Catania.

Remarks.—This well-known British species has been found but rarely in the Crag. Prof. Kendall obtained one or two specimens at Walton and Mr. A. Bell at Butley, while it was reported in 1864 by Dr. S. P. Woodward from the Icenian Crag of Thorpe. I have found a few at Oakley, several of them immature, and in the March gravels. *H. rufa* is unknown from any horizon of the Italian Pliocene, but it appeared in the Mediterranean in Pleistocene times, where it still lingers on, being found, according to Dr. Carus, on the coasts of Provence.

H. rufa is considered by Forbes and Hanley and by Jeffreys an equivalent to Couthouy's North American shell, *Fusus pleurotomarius* (Boston Journ. Nat. Hist., vol. ii, p. 107, pl. vi, fig. 9).

Var. **Ulideana** (Thompson). Plate XXIX, figs. 9, 10.

1845. *Pleurotoma Ulideana*, Thompson, Ann. Mag. Nat. Hist. [1], vol. xv, p. 316, pl. xix, fig. 2.
1853. *Mangilia rufa*, var. *Ulideana*, Forbes and Hanley, Brit. Moll., vol. iii, p. 457, pl. cxii, fig. 5.
1867. *Pleurotoma rufa*, var. *Ulideana*, Jeffreys, Brit. Conch., vol. iv, p. 393.
1888. *Pleurotoma rufa*, var. *Ulideana*, A. Bell, Rep. Brit. Assoc. (Bath), p. 136.

Varietal Characters.—Differs from the type in its stronger sculpture; the longitudinal ribs are fewer and more prominent, the whorls more convex, the suture deeper, and the spire more slender and elongate.

Distribution.—Recent: Strangford Lough, Co. Down, Connemara, Oban, Clyde district, Skye.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Bentley. Wexford gravels (A. Bell).

Remarks.—I have a single specimen of this well-marked variety from Oakley which corresponds with some shells in the Holmes Collection at the Norwich Castle Museum, one of which I have figured with it. The type specimen from Strangford Lough (*op. cit.*), from which this form was originally described, was somewhat more slender than our Crag shell; otherwise it agrees with it.

Genus **RAPHITOMA**, Bellardi, 1847.

Raphitoma harpula (Brocchi). Plate XXX, figs. 1, 2.

1814. *Murex harpula*, Brocchi, Conch. foss. Subap., vol. ii, p. 421, pl. viii, fig. 12.
1844. *Pleurotoma harpula*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 173.
1847. *Raphitoma harpula*, Bellardi, Mem. R. Accad. Sci. Torino [2], vol. ix, p. 629.
1873–5. *Raphitoma harpula*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 100, 1873; vol. v, p. 276, no. 37, 1874; vol. vi, p. 210, no. 233, 1875.
1877. *Raphitoma harpula*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 320.
1882. *Raphitoma harpula*, S. V. Wood, junr., Mon. Crag Moll., 3rd Suppl., p. 5, pl. i, fig. 4.
1889. *Raphitoma harpula*, Sacco, Boll. Soc. Ital. Geol., vol. ix, p. 284, no. 4357.
1914. *Peratotoma* (*Amblyacrum*) *harpula*, Cipolla, Palaeont. Ital., vol. xx, p. 172, pl. xiv, fig. 23.

Specific Characters.—Shell slender, turreted; spire elongate, ending in an acute point; suture deep; whorls 8—9, short, distinctly convex, the last two-fifths the total length; ornamented with ten or twelve prominent, sharply-edged longitudinal costæ, narrower than the spaces between them, nearly straight on the upper whorls, curved on the last, and by fine, thread-like spiral lines which cross, and are plainly marked on the ribs; mouth oval, short, angulate above, ending in a short and open canal which turns slightly to the left.

Dimensions.—L. 20 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley. Upper Miocene: Northern Italy. Lower Pliocene: Castelnuova d'Asti, Savona, Albenga. Upper Pliocene: Biot, Orciano, Bologna, Livorno, Monte Mario, Altavilla, Messina.

Remarks.—The genus *Raphitoma* includes a special group of small inoperculate Pleurotomas, subfusiform and longitudinally costated.

Wood figures a small specimen of this species which was found at Boyton by the late R. G. Bell; it is smaller and less elongate than the type. The one now given, with a specimen from the Italian Pliocene for comparison, is from Oakley, and approaches more nearly the latter and the shell originally represented by

Brocchi. Although broken it is in fresh condition and shows no sign of derivation.

Dr. Cipolla includes this species in the genus *Peratotoma*. Fischer regarded it as the type form of *Raphitoma*.

Raphitoma attenuata (Montagu). Plate XXX, figs. 8, 9.

1803. *Murex attenuatus*, Montagu, Test. Brit., pt. i, p. 266, pl. ix, fig. 6.
1836–44. *Pleurotoma gracile*, Philippi, Enum. Moll. Siciliæ, vol. i, p. 198, pl. xi, fig. 23, 1836; *P. attenuata*, vol. ii, p. 160, 1844
1853. *Mangelia attenuata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 488, pl. cxiii, figs. 8, 9.
1867. *Pleurotoma attenuata*, Jeffreys, Brit. Conch., vol. iv, p. 377, pl. xc, fig. 2.
1873–5. *Raphitoma attenuata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 97, 1873; vol. v, p. 276, no. 35, 1874; vol. vi, p. 210, no. 225, 1875.
1877. *Raphitoma attenuata*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 315.
1883. *Raphitoma attenuata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 101, pl. xiv, fig. 25.
1890. *Raphitoma attenuatum*,[1] Carus, Prod. Faun. Medit., vol. ii, p. 422.
1905. *Raphitoma* (*Villiersiella*) *attenuatum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 380, pl. xcvii, figs. 11—14.
1910. *Raphitoma attenuata*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 70, pl. vi, figs. 52—58.
1914. *Daphnella* (*Raphitoma*) *attenuata*, Cipolla, Palaeont. Ital., vol. xx, p. 165, pl. xiv, figs. 14, 15.

Specific Characters.—Shell slender, attenuated at both ends; whorls somewhat convex, slightly angulated above, the last four-sevenths the total length; ornamented by narrow, flexuous ribs extending to the suture and to the base of the shell; spire long and gradually tapering; suture deep; mouth narrow, contracted, passing into a long and straight canal; pillar nearly straight.

Dimensions.—L. 10—14 mm. B. 3—4 mm.

Distribution.—Recent: British coasts, especially to the south and west. South Sweden. Mediterranean. Adriatic. Ægean.

Fossil: Coralline Crag: Gedgrave, Sutton. Waltonian: Little Oakley. Butleyan: Butley. Pleistocene: Belfast.

Upper Pliocene: Colle Astesi, Válle Andona, Altavilla, Monte Mario, Biot. Pleistocene: Italy—Reggio, Válle Biaia; Sicily—Ficarazzi, Monte Pellegrino.

Remarks.—This British species, characteristic of the Upper Pliocene deposits of Italy and generally diffused as a Recent shell in the Mediterranean, may be regarded as mainly a southern form. The typical variety has not been noticed hitherto in our Crag deposits, that figured by Wood under the present name

[1] The use of the neuter gender has been recently revived for the specific names of the genera *Raphitoma*, *Pleurotoma*, etc. Although more correct, its general adoption would require such an enormous disturbance of the long-established nomenclature that it seems to me undesirable and, as I think, unnecessary.

representing rather var. *tenuicosta*, Brugnone = *R. volvula*, A. Bell (see below). I have several specimens of it, however, in my collection from Oakley, most of them fragile and more or less imperfect; probably it might be found elsewhere, if especially looked for.

Var. **tenuicosta** (Brugnone). Plate XXX, figs. 10, 11.

1862. *Pleurotoma attenuatum*, var. *B, tenuicosta*, Brugnone, Mem. Pleur. foss. Palermo, p. 25, fig. 17.
1871. *Pleurotoma volvula*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 358.
1871. *Pleurotoma attenuata*, var. *tenuicosta*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 494.
1872. *Pleurotoma attenuata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 38, pl. iii, fig. 7.
1875. *Raphitoma attenuata*, var. *tenuicosta*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 210, no. 225.
1912. *Pleurotoma attenuata*, var. *volvula*, Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 90, no. 233.

Varietal Characters.—Differs from the type in its more slender form, its more numerous and less prominent costæ, its somewhat flatter whorls and rather longer body-whorl and mouth.

Dimensions.—L. 14 mm. B. 4 mm.

Distribution.—*Recent:* Sicily.

Fossil: Coralline Crag: Gedgrave, Sutton, Boyton. Waltonian: Little Oakley. Scaldisien: Dutch borings at Grave-Oss.

Upper Pliocene: Altavilla. Pleistocene: Ficarazzi.

Remarks.—The shell represented under this name is that described by Mr. A. Bell in 1871 as a new species—*Pleurotoma volvula*. It was afterwards identified, and I think correctly, by Jeffreys with a Sicilian fossil from Ficarazzi, which had been called by Brugnone in 1862 *Pleurotoma attenuatum*, var. *tenuicosta*. Mr. Bell's fossils were considered by Wood also as a variety of *R. attenuata*. I understand this form was obtained rather abundantly some years ago in the Coralline Crag of the celebrated Gomer pit at Gedgrave. Dr. Tesch has sent me two or three specimens from beds believed by him to be Scaldisien, met with in one of the Dutch borings at Grave-Oss.

The present variety seems to me distinct and worthy of notice, occurring fossil as it does on both sides of the Anglo-Belgian basin as well as in Sicily.

Var. **gracilior** (A. Bell). Plate XXX, fig. 12.

1871. *Pleurotoma gracilior*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 357.

Varietal Characters.—Smaller and more slender than the type, with a long, narrow mouth, and exceedingly fine spiral sculpture.

Dimensions.—L. 12 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave. Waltonian: Walton-on-Naze (Kendall).

Remarks.—The shell here figured belongs to the Reed collection at York. Mr. A. Bell informs me it is the original specimen upon which his description of *Pleurotoma gracilior* was founded. By some misunderstanding this name was given to another shell in the 3rd Supplement to the Monograph of the Crag Mollusca. *R. gracilior*, S. V. Wood, jun., Mon. Crag Moll., 3rd Suppl., p. 4, pl. i, fig. 5, 1882, is a different shell.

Var. **notata** (A. Bell). Plate XXX, fig. 13.

1871. *Pleurotoma notata*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 358.

Varietal Characters.—Shell fusiform, shorter than the type; whorls slightly convex, covered with fine spiral striæ, and having eight to ten longitudinal ribs on the second whorl; body-whorl excavated towards the base, forming an open canal; mouth narrow; outer lip sharp; inner lip reflected over a slightly sinuous pillar; suture distinct.

Dimensions.—L. 12 mm. B. 4—5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag (Gedgravian): Gomer pit. Waltonian: Little Oakley.

Remarks.—This is another of the *attenuata* group, which in 1871 Mr. Alfred Bell proposed to call *Pleurotoma notata*. Both Wood and Jeffreys regarded it, however, as a variety of the species named above. Mr. Bell has lately identified the specimen from Oakley here figured with those from the Coralline Crag upon which his original description was based. He says they were covered with spiral striæ, most of them fine, but some coarse and elevated; in one of these the coarser striæ retained their original pink colour. It should be noticed that in the type form of *R. attenuata* the spiral striæ are microscopical.

Raphitoma plicatella, Bellardi. Plate XXX, fig. 7.

1847. *Raphitoma plicatella*, Bellardi (ex Jan, MS.), Mem. R. Accad. Sci. Torino [2], vol. ix, p. 620, pl. iv, fig. 18.

1856. *Pleurotoma plicatella*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 374, pl. xl, figs. 5, 6.

1875. *Raphitoma plicatella*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 210, no. 212.

1877. *Raphitoma plicatella*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 307, pl. ix, fig. 19.

1890. *Raphitoma plicatella*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 283, no. 4338.

1910. *Raphitoma plicatella*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 65, pl. vi, fig. 15.

Specific Characters.—Shell strong, ovato-fusiform; whorls 7, convex, obscurely carinate, the last about two-thirds the total length; ornamented by about fourteen sinuous costæ on the upper whorls and eight to ten on the last, reaching the base of the shell, intersected by fine thread-like and rather distinct spiral lines; suture slight; mouth long, narrow, acutely angulate above, continuous with a short canal, which bends slightly to the left; outer lip gently rounded, not expanded; columella fairly straight.

Dimensions.—L. 14—18 mm. B. 5—7 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Upper Miocene: Italy, Stazzano. Vienna basin. Lower Pliocene: Castelnuovo d'Asti, Savona, Albenga. Upper Pliocene: Monte Mario, Orciano, Bologna, Altavilla, Biot.

Remarks.—I have one specimen from Oakley, perfect though worn, which, though somewhat smaller than the Italian fossil, I refer with some doubt to the same species. It is specially characterised by having fewer longitudinal costæ on the last whorl than on the upper ones. Our Crag shell agrees more nearly in form and sculpture with Bellardi's figure and with a specimen in my collection from the Rio Torsero, near Albenga, than with that given by Hörnes under the same name.

Raphitoma similis (Nyst). Plate XXIX, figs. 28, 29.

1872. *Pleurotoma hispidula,* S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 42, pl. iii, fig. 3.
1881. *Pleurotoma similis,* Nyst, Conch. Terr. Tert. Belg., p. 55, pl. iii, fig. 19.
1912. *Pleurotoma similis,* Tesch, Med. v. d. Rijks. v. Delfstoffen, pt. iv, p. 90, no. 230.

Specific Characters.—Shell elongato-fusiform; whorls 7, slightly convex, not distinctly carinate, the last much the largest, two-thirds the total length; ornamented by many rather inconspicuous longitudinal ribs, which tend to die out towards the base of the shell, and by fine, closely-set thread-like spiral lines, giving it a faintly decussated appearance; mouth fairly long, oval, angulate above, nearly equalling the spire in length; outer lip thin; inner lip smooth and polished; canal short, open.

Dimensions.—L. 14—18 mm. B. 5—7 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gomer, Boyton. Waltonian: Little Oakley. Icenian: Aldeby. Scaldisien: Belgium, Holland.

Remarks.—This species originally described by Nyst, which, as far as I know, has only been observed in the Crag of the Anglo-Belgian basin, is probably the same as the one figured by Wood as *P. hispidula* (*op. cit.*). Although belonging to the same group, it presents certain well-marked differences which entitle it, I

think, to be considered specifically distinct. The longitudinal ribs are fewer in the latter and more prominent, the upper part of the whorls being distinctly keeled, whereas in the present shell they are rounded or but obscurely angulate; the spiral sculpture, moreover, is different. My Crag specimens agree perfectly with Nyst's species, *R. similis*, of which I figure one for comparison from the Brussels Museum, received from my friend, M. Rutot. I have no hesitation in regarding them as identical.

Dr. Tesch has sent me a fossil from the Scaldisien deposits met with in one of the Dutch borings which is evidently the same.

I have one or two specimens from Oakley in my collection, more slender than the type with a rather longer canal, which approach that figured in 1881 by Nyst as *P. subulata* (*op. cit.*, p. 51, pl. iii, fig. 16). M. Rutot informed me some time ago that the original could not be found. The latter seems closely allied to *R. similis*, and may possibly be a variety of that species.

Raphitoma hispidula, Bellardi. Plate XXIX, fig. 27.

1847. *Raphitoma hispidula*, Bellardi (ex Jan, MS.), Mem. R. Accad. Sci. Torino [2], vol. ix, p. 620, pl. iv, fig. 17.
1853. *Pleurotoma plicatella*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 374, pl. xl, fig. 5.
1870. *Pleurotoma hispidula*, A. Bell, Journ. de Conch, vol. xviii, p. 347, no. 258.
1872. *Mangelia hispidula*, von Koenen, Mioc. Nord-Deutsch. Moll. Fauna, pt. i, p. 114, pl. iv, fig. 17.
1873. *Raphitoma hispidula*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 296, no. 90.
1877. *Raphitoma hispidula*, var. *A*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 304, pl. ix, figs. 17, 18.
1890. *Raphitoma hispidula*, var. *pliocostatissima*, Sacco, Boll Soc. Geol. Ital., vol. ix, pp. 176, 283, no. 4335.
1914. *Daphnella* (*Raphitoma*) *hispidula*, Cipolla, Palaeont. Ital., vol. xx, p. 164, pl. xiv, figs. 11, 12.

Specific Characters.—Shell rather thin, subfusiform, turreted; whorls 8, convex, the last much the largest, two-thirds the total length; ornamented by narrow and acute longitudinal costæ, about eighteen on the body-whorl, nearly reaching the base of the shell, not so wide as the intervening spaces, and by a distinct keel with a sloping ledge above it; also by unequally spaced and fine spiral lines, a few of them more prominent than the others, with others, almost inconspicuous, between them; spire attenuate, rapidly diminishing; apex acute; mouth long, narrow, acutely angulate above, continuous with the canal which turns slightly to the left; outer lip not expanded, angulated by the keel; labial sinus shallow and inconspicuous.

Dimensions.—L. 15 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley?

Miocene: North Germany, Vienna basin, Italy. Lower Pliocene: *argiles*

bleues of Ligurian coast. Upper Pliocene: Biot, Colle Astesi, Val Andona, Monte Mario, Altavilla. Pleistocene: Monte Pellegrino, Válle Biaia.

Remarks—In his Monograph of 1848 Wood figured two rather different specimens under the name of *Pleurotoma concinnata*, one of them approaching, though not very nearly, the shell last described as *R. similis*. They were afterwards referred by Jeffreys in 1871 to *P. decussata*,[1] Phil., and in 1872 by Wood to *P. hispidula*,[2] but I am compelled to doubt the correctness of both those identifications. I have an imperfect shell from Oakley, not good enough to be figured, which may belong to the present species. As it is apt to be confounded with *R. similis* I figure a specimen from the Italian Pliocene in order to call the attention of collectors to the matter, and to show the difference between the two. It seems to be the variety *A* of Bellardi.

Raphitoma brachystoma (Philippi). Plate XXX, figs. 30, 31.

1844. *Pleurotoma brachystomum*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 169, pl. xxvi, fig. 10.
1848. *Clavatula brachystoma*, S. V. Wood, Mon. Crag Moll., pt. i, p. 60, pl. vii, fig. 8.
1853. *Mangelia brachystoma*, Forbes and Hanley, Brit. Moll., vol. iii, p. 480, pl. cxiv, figs. 5, 6.
1867. *Pleurotoma brachystoma*, Jeffreys, Brit. Conch., vol. iv, p. 382, pl. xc, fig. 5.
1873–5. *Raphitoma brachystoma*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 92, 1873; vol. vi, p. 210, no. 219, 1875.
1877. *Raphitoma brachystoma*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 318, pl. ix, fig. 34.
1881. *Pleurotoma brachystoma*, Nyst, Conch. Terr. Tert. Belg., p. 53, pl. iii, fig. 18.
1890. *Raphitoma brachystoma*, Carus, Prod. Faun. Medit., vol. ii, p. 422.
1901. *Mangelia brachystoma*, Brøgger, Norges geol. undersøgelse, vol. xxxi, pp. 514, 662, pl. xvii, fig. 7.
1905. *Raphitoma* (*Ginnania*) *brachystomum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 378, pl. xcvii, figs. 6—8.
1910. *Raphitoma brachystoma*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 68, pl. vi, figs. 35—43.
1912. *Pleurotoma brachystoma*, Tesch, Med. v. d. Rijks. v. Delfstoffen, vol. iv, p. 90, no. 229.

Specific Characters.—Shell minute, turreted; whorls convex, angulated and shelf-like above, the last rather more than half the total length; ornamented by about eight strong and prominent longitudinal ribs and by fine thread-like spiral ridges, wavy and unequal, which cross the ribs; upper whorls smooth and glossy; spire regularly diminishing in size; apex blunt and abrupt: suture deep; mouth narrow, angulated above; canal short, rather wide: labial notch small; pillar short.

Dimensions.—L. 6—8 mm. B. 2—3 mm.

Distribution.—Recent: Great Britain, Cornwall to Shetland, principally western. Dogger Bank. Southern Coasts of Norway and Sweden. West European, Mediterranean, Adriatic, Ægean, North African coast.

[1] Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 487, 1871.
[2] Mon. Crag Moll., 1st Suppl., pt. i, p. 42, 1872.

Fossil: Coralline Crag: Boyton, Gedgrave, Sutton, abundant. Waltonian: Walton-on-Naze, Little Oakley. St. Erth. Pleistocene: Torbay, Belfast.

Lower Pliocene: Italy—Vezza near Alba. Upper Pliocene: Monte Mario, Colle Astesi, Bologna, Biot, Altavilla. Scaldisien: Belgium, Holland. Pleistocene: Monte Pellegrino, Ficarazzi. Tapes-banks, Christiania.

Remarks.—This is one of the British shells having a more or less southern range that we find in the Coralline and Waltonian Crags, and in the Scaldisien of Belgium. Wood says it is not rare in the Coralline, Prof. Kendall reports it to be common at Walton, and I have found about a dozen specimens at Oakley. It occurs also, according to Prof. Brøgger, with a large number of other Lusitanian species in the post-glacial Tapes-banks of the Christiania fiord already referred to, deposits the fauna of which indicates, as before stated, a milder climate than that now existing in the same region.

In 1867 Jeffreys expressed the opinion (*op. cit.* p. 383), that the shell described by Wood as *Clavatula brachystoma* was wrongly identified, suggesting it might be some extinct species, but subsequently, in 1871, he considered it to be a variety of *P. concinnata*, S. V. W., a much larger shell, or of *P. decussata*, Phil. His views as to the limits of variation, applied to the Crag fossils, were sometimes very wide.

As Wood's non-photographic figure of this form does not appear to be very good, I have represented one of his Coralline Crag specimens from the Norwich Museum, with a Recent shell from the Mediterranean. They seem to me alike.

Mr. A. Bell has reported *R. brachystoma* from St. Erth,[1] and Mr. R. Lloyd Praeger from the estuarine clays of Belfast.[2] The shell figured by Dr. Cipolla under the present name (*op. cit.*, p. 169, pl. xiv, fig. 19) is much longer in the spire than specimens from the Crag.

Raphitoma Payraudeaui (Deshayes). Plate XXX, fig. 38.

1837. *Pleurotoma Payraudoti*, Deshayes, Exped. scient. Morée, p. 178.
1844. *Pleurotoma Payraudeaui*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 175, pl. xxvi, fig. 20.
1873–5. *Raphitoma attenuata*, var. *Payraudeauti*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 97, 1873; vol. vi, p. 210, no. 225, 1875.
1890. *Raphitoma Payraudeauti*, Carus, Prod. Faun. Medit., vol. ii, p. 423.
1905. *Raphitoma Payraudeaui*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 384, pl. xcviii, fig. 6.

Remarks.—Shell minute, slender, fusiform; whorls convex; spire elongate, regularly diminishing in size; ornamented by about eight well-marked costæ, reaching the suture and flexuous on the body-whorl, not so wide as the intervening

[1] Trans. Roy. Geol. Soc., Cornwall, vol. xii, p. 173, 1897.
[2] Proc. Roy. Irish Acad. [3], vol. ii, p. 265, 1892.

spaces, as well as by excessively fine spiral striæ, only visible by the aid of a lens; suture rather deep; mouth oblong, angulate above; outer lip thin, gently curved, not expanded; canal fairly long, narrow.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—*Recent:* Mediterranean, including the Algerian Coast.

Fossil: Coralline Crag: Sutton.

Upper Pliocene: Biot, Bologna, Altavilla, Val d'Era. Pleistocene: Livorno, Válle Biaia, Reggio, Ficarazzi.

Remarks.—When examining Wood's collection of Coralline Crag fossils at the Norwich Museum, I discovered an unnamed specimen of the charming little shell here figured that had lain there unrecognised for thirty years. I consider it may be identified with *R. Payraudoti* (*Payraudeaui*) of Deshayes. Except that the end of the canal had been broken it seemed complete, corresponding satisfactorily with the figures given by Philippi and Prof. Kobelt. It is a distinct species and easily recognised.

I believe the molluscan fauna of the Crag is much richer than is generally supposed, and that future collectors will be able to add largely to our knowledge of these deposits. During my twelve years' work at Oakley new things were constantly turning up. I never visited that place without getting something I had not found there before.

Raphitoma tenuistriata (A. Bell). Plate XXIX, figs. 31, 32.

1848. *Clavatula lævigata* (?), S. V. Wood, Mon. Crag Moll., pt. i, p. 62, pl. vii, fig. 12.
1871. *Pleurotoma tenuistriata*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 357.
1872. *Pleurotoma tenuistriata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 41.

Specific Characters.—Shell elongato-conical, regularly tapering; whorls 7—8, smooth, nearly flat; ornamented by excessively fine spiral striæ, hardly visible without the aid of a lens; spire sometimes equalling, at other times exceeding half the total length, ending rather abruptly in a blunt apex; suture slight; mouth comparatively short, oblong, acutely angulate above; canal wide, very short; labial sinus inconspicuous.

Dimensions.—L. 10—15 mm. B. 3—5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton, Sutton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Sutton.

Remarks.—This shell, originally described doubtfully by Wood from some imperfect specimens as *Clavatula lævigata*, was afterwards referred by him to a new species, for which Mr. A. Bell had proposed, in 1871, the name of *P. tenuistriata*. It appears to be a very distinct form which at present has only been noticed in the

East Anglian Crag. It is rather common at Oakley, where I have obtained 100 specimens of it. There are others from the Coralline Crag at the British Museum (Natural History) and in the Sedgwick Museum at Cambridge.

My Oakley fossils vary in size and in the comparative length of the spire.

Var. **carinata,** nov. Plate XXIX, fig. 33.

This variety, which is from Oakley, agrees with the type form in general appearance and its excessively fine and characteristic spiral striation, but it is smaller and the whorls are distinctly angulated.

Raphitoma senilis (S. V. Wood). Plate XXX, fig. 3.

1872-9. *Pleurotoma senilis*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 42, pl. v, fig. 5, 1872; 2nd Suppl., p. 20, pl. iii, fig. 2, 1879.

Specific Characters.—Shell slender, rather large, strong and solid; spire elongate; whorls 8, slightly convex, the last three-fifths the total length; ornamented by ten to twelve coarse longitudinal costæ, oblique or sinuous on the last whorl and by fine spiral ridges which extend to the base of the shell; suture slight; mouth long, narrow, acutely angulate above, passing continuously into a short, wide canal.

Dimensions.—L. 25—30 mm. B. 8—9 mm.

Distribution.—Not known living.

Fossil: Coralline Crag ?. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Sutton, Waldringfield.

Remarks.—The two specimens of this shell figured by Wood are in the Ipswich Museum, and I have several fragments, evidently the same, from Oakley. They are all more or less worn, but I do not think they are derivative.

Raphitoma Garlandi, sp. nov. Plate XXX, fig. 4.

Specific Characters.—Shell slender, subfusiform; whorls 7, slightly convex, the last about three-fifths the total length; spire elongate, gradually and regularly tapering, ending in a blunt point; ornamented by numerous longitudinal ribs, straight on the upper valves, sinuous on the last, extending nearly to the base of the shell; suture well marked; mouth long, narrow, angulate above; outer lip gently rounded, not expanded, passing without break into a short and open canal.

Dimensions.—L. 21 mm. B. 7 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Remarks.—I dedicate this charming shell, which is new to the Crag and, as far as I know, to science, to A. M. Garland, Esq., of Michaelstow Hall, near Dovercourt, the owner of the Crag pit at Little Oakley, which has yielded a fauna of such extraordinary interest and variety, and has latterly attained a European reputation. It is impossible for me to appreciate too highly his courtesy in allowing me to continue my investigations there on such a wholesale scale and during so many years.

Raphitoma valida, sp. nov. Plate XXX, figs. 22, 23.

Specific Characters.—Shell strong, subfusiform, much larger than *R. nebula* or its varieties; whorls 7 or 8, nearly flat, the last about half the total length; coarsely ornamented by 5 or 6 longitudinal costæ, slightly oblique, hardly reaching the base of the shell; spire elongato-conical, regularly diminishing in size; suture slight, oblique; mouth oval, angulate above, ending in a very short canal; outer lip gently curved, not expanded.

Dimensions.—L. 16 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Walton-on-Naze, Beaumont, Little Oakley.

Remarks.—The present shell seems a distinct form which is specially characterized by the small number of its coarse and irregularly sculptured longitudinal costæ. I have a dozen specimens or more of it from Oakley, and have found it also at the two other localities of the Waltonian Crag, but not elsewhere. Its affinities appear to be with the *R. nebula* group, but it is a much larger shell and cannot be regarded, I think, as a variety of that species. It may perhaps be met with at other horizons of the Red Crag if specially looked for; it can hardly be mistaken for anything else.

Raphitoma Woodii, sp. nov. Plate XXX, fig. 5.

Specific Characters.—Shell strong, subfusiform, elongate; whorls 7, but little convex, the last about half the total length; ornamented by fifteen longitudinal costæ, not very prominent, which reach the suture and almost to the base of the shell, also by numerous very fine but distinctly marked spiral ridges; suture slight; spire regularly diminishing in size, ending in a blunt point; mouth narrow, oval, angulate above; canal short, open.

Dimensions.—L. 20 mm. B. 7 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton.

Remarks.—The shell figured under this name is from the Sedgwick Museum at Cambridge, where it has been labelled *Clavatula plicifera*. I cannot think it corresponds closely enough to the imperfect specimen upon which the latter species was founded (Mon. Crag Moll., pt. i, p. 64, pl. vii, fig. 15) to justify that reference.

Although belonging to the same group as the one next to be described it appears to me a distinct form, deserving notice; as I cannot find anything agreeing with it, I dedicate it as a new species to the memory of my revered friend and master, S. V. Wood.

Raphitoma Smith-Woodwardi, sp. nov. Plate XXX, fig. 6.

1874. *Pleurotoma Bertrandi?*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. ii, p. 179, add. pl., fig. 4.

Specific Characters.—Shell strong, fairly large, slender, subfusiform; whorls 8, slightly convex, the last about half the total length, excavated below; ornamented by eight or nine longitudinal costæ, distinctly sculptured, but not very prominent, narrower than the intervening spaces, and by very fine inconspicuous spiral striation; spire elongate, regularly diminishing in size towards a blunt apex; suture well marked, but not deep; mouth oval, angulate above; canal short and open.

Dimensions.—L. 17 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton. Butleyan: Butley. Probably elsewhere in Red Crag.

Remarks.—There are three specimens from Boyton in one box at the British Museum labelled *Mangelia Bertrandi?*, with the doubt as to the identification of which I agree, the *Pleurotoma Bertrandi* of Payraudeau being a very different species, as may be seen by a reference to the original figure of its author,[1] or its reproduction by Prof. Kobelt.[2]

The drawing published by Wood in 1874 under the name of *P. Bertrandi* (*op. cit.*) seems intended for our shell, although it does not appear to have been very successful, the error in its identification having been due to the fact that, in his first volume of 1836, Philippi had figured a specimen under that name (*op. cit.*, pl. xi, fig. 20) to which Wood's shell had some resemblance; in his second volume (p. 168, 1844), however, the former admitted his mistake and referred it to a different species. The mistake remained, the acknowledgment of it was overlooked.

[1] Cat. Moll. Corse, p. 144, pl. vii, figs. 12, 13, 1826.

[2] Icon. schalentrag. europ. Meeresconch., vol. iii, p. 333, pl. xciii, figs. 6, 7.

There seems to be some doubt as to what the *M. Bertrandi* of Payraudeau really was, specimens I have seen under that name differing not only from each other, but also from the figures of the various authors who have described it. Probably it occurs in the Crag, but this I must leave for the present. However that may be, the shells now in question, which belong to *Raphitoma*, have nothing to do with it, a view with which my friend Mr. le B. Tomlin agrees. He has been kind enough to search through his very large collection of the Pleurotomidæ, but can find nothing to which they can be referred, expressing a strong opinion that they are a new and undescribed species allied to *R. nebula*.

I venture very cordially to associate these fossils with the name of the Secretary of the Palæontographical Society in friendly acknowledgment of the kind interest he has taken in the present Memoir, and the valuable assistance he has given me during its preparation.

Raphitoma megastoma (Brugnone). Plate XXIX, figs. 36, 37.

1862. *Pleurotoma megastomum*, Brugnone, Mem. Pleur. foss. Palermo, p. 34, pl. i, fig. 25.
1875. *Raphitoma megastoma*, Seguenza, Boll. R. Com. Geol. Italia, vol. vi, p. 210, no. 228.
1877. *Raphitoma megastoma*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 311, pl. ix, fig. 23.
1889. *Raphitoma megastoma*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 283, no. 4343.

Specific Characters.—Shell strong; spire turreted, with an obtuse apex; whorls 8 or 9, short, convex; having nine or ten prominent and flexuous longitudinal ribs, rather widely separated, extending to the base of the shell, with fine spiral striæ crossing them; suture deep; mouth oval, ending in a short and open canal.

Dimensions.—L. 12 mm. B. 4 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Beaumont, Little Oakley. Scaldisien: Belgium.

Lower Pliocene: Savona. Upper Pliocene: Colli Astesi, Válle Andona, Tortona, Altavilla.

Remarks.—I have five or six specimens of this well-marked Italian species from Beaumont and Oakley, and Mr. Van de Wouver has been kind enough to send me another from the Belgian Crag, all of them closely corresponding with some shells in my collection from the *argiles bleues* of the Ligurian coast. *Raphitoma megastoma* has not been previously recorded from the Anglo-Belgian basin.

Raphitoma turgida (Forbes). Plate XXIX, fig. 30.

1843. *Pleurotoma turgida*, Forbes, Rep. Moll. Ægean Sea, p. 139.
1843. *Pleurotoma turgida*, Reeve, Conch. Icon., vol. i (Pleurotoma), pl. xix, fig. 163.

1844. *Pleurotoma nanum*, Philippi, Enum. Moll. Siciliæ, vol. ii, pp. 169, 175, pl. xxvi, fig. 11.
1877. *Raphitoma turgida*, Bellardi, Moll. Terr. Terz. Piem., pt. ii, p. 312, pl. ix, fig. 25.
1889. *Raphitoma turgida*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 283, no. 4345.
1890. *Raphitoma turgidum*, Carus, Prod. Faun. Medit., vol. ii, p. 423.
1905. *Raphitoma turgidum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 386, pl. xcviii, figs. 19, 20.
1910. *Raphitoma turgida*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 66, pl. vi, figs. 25—29.

Specific Characters.—Shell small, ovato-fusiform; whorls 7, but little convex, regularly diminishing in size to a pointed apex, the last rather more than half the total length; spire conical; ornamented by eight to ten longitudinal costæ, oblique or sinuous, scarcely reaching the base of the shell, and by exceedingly fine spiral lines, hardly visible without the aid of a lens; suture slight; mouth comparatively narrow, oval, angulate above; outer lip gently rounded, not expanded; canal short, rather wide.

Dimensions.—L. 12 mm. B. 4 mm.

Distribution.—*Recent:* Mediterranean, Gibraltar to Sicily and Tunis. Adriatic. Ægean, coasts of Asia Minor. Portuguese coast, Cape Sagres.

Fossil: Coralline Crag: Gomer pit, Gedgrave.

Lower Pliocene: Italy—Válle Torsero, near Albenga. Upper Pliocene: Monte Mario.

Remarks.—The fossil here represented is from the Sedgwick Museum at Cambridge, and was found in the Gomer pit by the late Mr. Montagu-Smith. It agrees more or less nearly with the specimens figured by Reeve, Prof. Kobelt, and Sign. Cerulli-Irelli as *R. turgida*, and with that of the *Pleurotoma nanum* of Philippi. Prof. Kobelt reproduces both Reeve's figure and that of Philippi as the same species under the same name of *R. turgida*. Our fossil may be regarded, I think, as the Crag equivalent of that species.

The specimen upon which the latter was founded was dredged by Prof. Forbes in 83 fathoms off Cape Artemisium on the coast of Asia Minor. It was obtained also by the "Porcupine" expedition off Cape Sagres in 45—58 fathoms. It is interesting to notice how many shells, now found at a considerable depth, have been met with in the comparative shallow-water deposits, not only of the Coralline but also of the Red Crag.

Raphitoma nana (Scacchi). Plate XXX, figs. 32—34.

1836. *Pleurotoma nana*, Scacchi, Cat. Conch. Regn. Neap., p. 13, fig. 20.
1873–5. *Raphitoma nana*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 106, 1873; vol. vi, p. 210, no. 232, 1875.

Specific Characters.—Shell small, solid, ovato-fusiform; whorls 6 or 7, concave, the last two-thirds the total length, excavated below; ornamented by about eight

strong, prominent and flexuous costæ, reaching the suture and the base of the shell, and by excessively fine spiral lines; suture slight; mouth oval, not expanded, angulate above; canal distinct, short.

Dimensions.—L. 7—10 mm. B. 3—4 mm.

Distribution.—*Recent:* Mediterranean.

Fossil: Coralline Crag: Gomer Pit.

Upper Pliocene: Altavilla, Bologna, Caltabiano. Pleistocene: Messina, Livorno, Válle Biaia (Seguenza).

Remarks.—When studying the smaller forms of the present group one is often in doubt how far the figures of the earlier writers can be depended on for the identification of our Crag fossils. In the present case those of Scacchi and Philippi differ so widely that it is hard to decide whether or not these authors were referring to the same shell, that of the latter approaching the *R. turgida* of Forbes, to which species, indeed, the *R. nana* of Scacchi has been generally referred. I have, however, received some specimens from my friend, the Marchese di Monterosato, for whose friendly and repeated assistance I can hardly feel sufficiently grateful, which lead me to think the two species may be regarded as distinct; some of these specimens he calls *R. nana* (Pl. XXX, fig. 32), informing me they were taken from the collection of the Sicilian palæontologist Brugnone; others, from the Pliocene deposit of Altavilla, he describes as *R. nana*, "*proxima*" (fig. 34). In the Montagu-Smith collection of the Sedgwick Museum at Cambridge there is a fossil from the Coralline Crag of the Gomer Pit (fig. 33) belonging to the same group, and apparently identical with the latter; allowing for the want of conchological accuracy so frequently shown in the figures of the artists of the early part of the nineteenth century, it does not seem unreasonable to suppose that at least one of these represents the form originally represented by Scacchi. If I am correct in referring the shell described above to the *R. turgida* of Reeve (Forbes) this can hardly be regarded as the same. Philippi's drawing of *R. nana* I am inclined to regard as *R. turgida*. As Seguenza's shells were not figured it seems impossible to decide to which of these forms the fossils given by him as *R. nana* belong.

Raphitoma mitrula (S. V. Wood, ? Sowerby). Plate XXIX, figs. 23—25.

1848. *Clavatula mitrula*, S. V. Wood, Mon. Crag Moll., pt. i, p. 59, pl. vii, fig. 7.

1871. *Pleurotoma costata*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488.

1881. *Pleurotoma costata*, Nyst, Conch. Terr. Tert. Belg., p. 52, pl. iii, fig. 17.

Specific Characters.—Shell turreted, subfusiform; whorls 6—7, convex; ornamented by about ten strong, rounded, and prominent longitudinal ribs, which hardly reach the base of the shell, and by irregular, inconspicuous spiral lines, not

very clearly sculptured; spire elongate, regularly tapering; apex small, rounded; suture deep; mouth ovate with a well-marked labial sinus below the suture; outer lip thin, curved, slightly expanded, continuous with a short and open canal.

Dimensions.—L. 14 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton and Gedgrave (very rare), Boyton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley (very abundant). Newbournian and Butleyan (*passim*, but not so common). Icenian: Postwick (*fide* Wigham)? Scaldisien: Antwerp.

Remarks.—The name *mitrula* for the present species has been attributed to Sowerby, but I think this is open to question. The shell described by him as *Buccinum mitrula* (Min. Conch., vol. iv, p. 103, tab. cccIxxv, fig. 3) seems to me different from that known to Wood, and since then to Crag geologists generally under that name. In fact, Sowerby says it resembles in general form an Eocene species, *B. junceum*, which he figures on the same page. His figures are, perhaps, inaccurate, but they can hardly be in any case Wood's *R. mitrula*, nor is it possible to decide with certainty the species they are intended to represent. It seems desirable, therefore, to drop the reference to Sowerby, and for the future to attribute the present name to Wood. Wood's figures, though they have not the accuracy of a photograph, are meant no doubt for the present shell. Perhaps it should be stated that the fossil Nyst figured in 1843 as *P. mitrula* was afterwards referred by him to another species, so that Wood's name of 1848 has clearly the priority.

R. mitrula seems to be known only from the Pliocene deposits of the Anglo-Belgian basin. It occurs in extraordinary profusion in the Waltonian Crag. I have found at least 1000 specimens at Oakley. Its abundance at this stage makes its restricted range, both in time and space, the more remarkable.

R. mitrula is a somewhat variable form, one variety, not so prevalent as the type, being more slender, with an elongate spire. The species has a character of its own, however, by which it may be easily recognised. The special and rather distant transverse striation above referred to, which in full-grown specimens has often been nearly or wholly obliterated, is not clearly and regularly cut as in some other forms of *Raphitoma*.

The shell figured by Nyst in 1881 (*op. cit.*) as *Pleurotoma costata* seems to be of the present species.

Raphitoma striatula, sp. nov. Plate XXIX, fig. 26.

1844. *Pleurotoma striolata*, Philippi, Enum. Moll. Siciliæ, vol. ii, p. 168, pl. xxvi, fig. 7.

1872-4. *Pleurotoma striolata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 46, 1872; pt. ii, p. 179, add. pl., fig. 2.

1905. *Raphitoma* (*Smithiella*) *costulatum striolatum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 383, pl. xcvii, fig. 18.

Specific Characters.—Shell slender, subfusiform; spire elongate, regularly tapering; whorls 7, but slightly convex, subturreted; ornamented by nine or ten oblique, longitudinal costæ, not very prominent, which extend to the base of the shell and to the suture; suture oblique, well marked but not deep; mouth narrow, showing plainly the labial notch, passing almost without break into a short and open canal.

Dimensions.—L. 10—12 mm. B. 3—5 mm.

Distribution.—*Fossil:* Coralline Crag: near Orford. Waltonian: Little Oakley. Probably elsewhere in the Red Crag.

Remarks.—The present shell, which comes from my Oakley collection, agrees more or less nearly with that figured by Philippi, and one of those of Prof. Kobelt. That form was referred by its author to the *Mangelia striolata* of Scacchi, but, as explained on p. 249, the latter had been identified by him with Risso's species of the same name, a prior and different species. Whether Scacchi's identification was wrong or whether the mistake was Philippi's, it is impossible now to discover. I associate the Crag fossils with Philippi's shell, therefore, and not with that of Scacchi. As *striolata* has been already used, I propose a slightly different name for the present form.

The specimen figured by Wood, moreover, may be referred to Philippi's species and not to that described on p. 248 as *Mangelia Smithii.*

Raphitoma curtistoma (A. Bell). Plate XXX, figs. 27—29.

1871. *Pleurotoma curtistoma*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 357.
1879. *Pleurotoma curtistoma?*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 17, pl. ii, fig. 9.

Specific Characters.—Shell slender, subfusiform; whorls 8, but moderately convex, regularly diminishing in size, the last about half the total length; ornamented by about ten strong, but not very prominent longitudinal ribs, which reach the base, and by very fine spiral lines, only visible by the aid of a lens; spire elongated, regularly tapering; suture slight; mouth short, oval, rather wide, with the canal about one-third the length of the shell; canal very short and open; outer lip thin, regularly curved.

Dimensions.—L. 14 mm. B. 7 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Boyton. Waltonian: Little Oakley.

Remarks.—The type specimen of this fossil is in the Reed collection at the York Museum, associated with a label to that effect in Mr. Bell's writing. I have several others from Oakley, which seem to be the same. Jeffreys regarded it as

a variety of *R. attenuata* (Quart. Journ. Geol. Soc., vol. xxvii, p. 494, 1871), but this view I cannot accept.

It seems desirable that the verified specimen of this fossil should be figured for purposes of future reference. Wood's drawing of *R. curtistoma* is not a successful one, and he does not seem sure that it represents the specimen upon which the species in question was originally founded.

The shells from Oakley figured under the present name, although not absolutely the same as Mr. Bell's type specimen, may be regarded, I think, as a variety of it. I have found several specimens of the species at that place.

Raphitoma nebula (Montagu). Plate XXX, figs. 14—19.

1803. *Murex nebula*, Montagu, Test. Brit., pt. i, p. 267, pl. xvi, fig. 6.
1853. *Mangelia nebula*, Forbes and Hanley, Brit. Moll., vol. iii, p. 476, pl. cxiv, figs. 7—9.
1867. *Pleurotoma nebula*, Jeffreys, Brit. Conch., vol. iv, p. 384, pl. xci, fig. 1.
1872. *Pleurotoma nebula*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 45, pl. vii, fig. 7.
1873–5. *Raphitoma nebula*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 103, 1873; vol. vi, p. 210, no. 221, 1875.
1883. *Raphitoma nebula*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 99, figs. 22, 23.
1890. *Raphitoma nebula*, Carus, Prod. Faun. Medit., vol. ii, p. 421.
1901. *Mangelia nebula*, Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 662, pl. xvii, fig. 8.
1905. *Raphitoma (Ginnania) nebula*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 374, pl. xcvii, figs. 1, 2.
1910. *Raphitoma nebula*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 68, pl. vi, figs. 44—46.

Specific Characters.—Shell small, solid, elongato-conical; whorls more or less convex, sometimes depressed above, the last attenuated towards the canal; ornamented by strong, rounded, prominent ribs, and usually by fine spiral lines, the ribs nearly reaching the base, and in the Crag varieties to the suture; suture distinct; mouth oval, somewhat compressed, angulate above; canal short, fairly wide, turning slightly to the left; labial notch not conspicuous as in *R. mitrula*; outer lip gently curved, not expanded.

Dimensions.—L. 8—10 mm. B. 3—4 mm.

Distribution.—Recent: coasts of Great Britain and Ireland, southern coasts of Norway, northern France to Madeira, the Mediterranean, Adriatic and Ægean.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Sutton, Waldringfield, Newbourn, Felixstowe. Butleyan: Butley. Pleistocene: Moel Tryfan, Macclesfield.

Upper Pliocene: Northern Italy, Monte Mario, Altavilla. Pleistocene: Italy—Taranto, Válle Biaia; Sicily—Monte Pellegrino, Ficarazzi, Messina, Catania. Tapes-banks: Christiania, Trondhjem.

Remarks.—This species, though by no means abundant in the Crag, is represented there by several more or less distinct varieties, corresponding with forms

now living in British seas or in the Mediterranean, some of which it seems desirable to figure for the purpose of comparison.

The specimen figured by Wood in 1848 as *Pleurotoma nebula* (Mon. Crag Moll., pt. i, tab. vii, fig. 10), was afterwards regarded by him as an undescribed species for which he proposed the specific name *P. nebulosa*.

Prof. Brøgger reports *R. nebula* from the post-glacial Tapes-banks of Christiania, and Dr. Øyen from those of the Trondhjem district.

Var. **elongata,** Jeffreys. Plate XXX, figs. 20, 21.

1867. *Pleurotoma nebula*, var. *elongata*, Jeffreys, Brit. Conch., vol. iv, p. 385, pl. xci, fig. 2.
1883. *Raphitoma nebula*, var. *elongata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 101.
1910. *Raphitoma nebula*, var. *elongata*, Cerulli-Irelli, Palaeont. Ital., vol. xvi, p. 69, pl. vi, fig. 48.

Varietal Characters.—Differs from the type form in size, its more elongate and slender spire, and its less prominent sculpture.

Dimensions.—L. 12—15 mm. B. 3·5—5 mm.

Distribution.—Recent: Guernsey, Plymouth, Arran Isle, co. Galway, Hebrides, and Shetland. Finmark, Gothenburg, Brittany, Vigo.

Fossil: Waltonian Crag: Little Oakley. Pleistocene: Caithness. Upper Pliocene: Monte Mario.

Remarks.—This shell is considered a variety of *R. nebula* by the authorities quoted above. It seems to be an Atlantic rather than a Mediterranean form. I have several specimens from Oakley, and Sign. Cerulli-Irelli reports it from the Upper Pliocene of Monte Mario. Jeffreys remarks that he is by no means certain that this form may not be specifically distinct.

Var. **Ginnaniana** (Risso). Plate XXX, figs. 24, 25.

1826. *Mangelia ginnania*, Risso, Hist. Nat. Eur. Mérid., vol. iv, p. 220, pl. vii, fig. 99.
1836. *Pleurotoma ginnania*, Scacchi, Cat. Conch. Regn. Neap., p. 13.
1836–44. *Pleurotoma Bertrandi*, Philippi, Enum. Moll. Siciliæ, vol. i, p. 198, pl. xi, fig. 20, 1836; *P. ginnanianum*, vol. ii, p. 168, pl. xxvi, fig. 6, 1844.
1847. *Pleurotoma Ginnanianum*, Jeffreys, Ann. Mag. Nat. Hist. [1], vol. xix, p. 312.
1853. *Mangelia nebula*, var. *Ginnaniana*, Forbes and Hanley, Brit. Moll., vol. iii, p. 480.
1873–5. *Raphitoma nebula* (= *P. ginnanianum*, Scacchi), Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 103, 1873; *R. nebula*, var. *Ginnaniana*, vol. vi, p. 210, no. 221, 1875.
1883. *Raphitoma nebula*, var. *Ginnania*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 101.
1890. *Raphitoma Ginnanianum*, Carus, Prod. Faun. Medit., vol. ii, p. 420.
1905. *Raphitoma* (*Ginnania*) *nebula ginnanianum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 379, pl. xcvii, fig. 9.

Varietal Characters.—Differs from the type in its stronger and more prominent costæ, and in its more elongate spire.

Dimensions.—L. 8—12. B. 3—5.

Distribution.—Recent: British coasts, southern and western, Shetland. Mediterranean, generally diffused. Adriatic, Ægean.

Fossil: Waltonian Crag: Little Oakley.

Upper Pliocene: Altavilla. Pleistocene: Sicily—Messina, Monte Pellegrino, Ficarazzi, Catania; Italy—Taranto, Válle Biaia.

Remarks.—This shell, originally regarded as a distinct species, is now generally considered as a variety of *R. nebula*. It has a southern range, and, according to MM. Bucquoy and his coadjutors, is the form of that species most frequently met with in the Mediterranean, being specially distinguished by its strong and prominent costæ. It has not been hitherto recorded from the Crag, but I have a solitary specimen from Oakley, where everything seems to occur, which appears to correspond with a Recent example from the Mediterranean that M. Dautzenberg has kindly sent me for comparison. It was first figured by Risso and since then by the various authors quoted above. Their figures, although not identical in form, agree in presenting a shell with prominent sculpture and an elongate spire.

The specific name *ginnania*, since changed to *Ginnaniana*, has been sometimes attributed to Scacchi, but Risso's description is the earlier.

Var. **delicatula**, nov. Plate XXX, fig. 26.

Dimensions.—L. 12 mm. B. 4 mm.

Distribution.—Not recorded living.

Fossil: Waltonian Crag: Little Oakley.

Remarks.—In form this charming little shell agrees to some extent with Philippi's original figure of *P. ginnanianum*, and may, therefore, be regarded with it as a variety of *R. nebula*. Its spiral sculpture, however, differs from that of the usual varieties of that species, consisting of delicate and rather distant thread-like ridges, with excessively fine lines in the interspaces. It is larger, moreover, bearing a somewhat similar relation to it that the var. *elongata* of *R. nebula* does to the typical form.

Raphitoma lævigata (Philippi). Plate XXX, figs. 35—37.

1836–44. *Pleurotoma lævigatum*, Philippi, Enum. Moll. Siciliæ, vol. i, p. 199, pl. xi, fig. 17, 1836; vol. ii, p. 169, 1844.

1845. *Pleurotoma lævigata*, Reeve, Conch. Icon., vol. i (Pleurotoma), pl. xxxii, fig. 291.

1853. *Mangelia nebula*, var. *lævigata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 476.

1867. *Pleurotoma lævigata*, Jeffreys, Brit. Conch., vol. iv, p. 386, pl. xci, fig. 3.

1872. *Pleurotoma lævigata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 42, pl. vi, fig. 15.
1873–5. *Raphitoma nebula*, var. *lævigata*, Seguenza, Boll. R. Com. Geol. Italia, vol. iv, p. 298, no. 103, 1873; vol. vi, p. 210, no. 221, 1875.
1883. *Raphitoma nebula*, var. *lævigata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 101.
1890. *Raphitoma lævigatum*, Carus, Prod. Faun. Medit., vol. ii, p. 421.
1905. *Raphitoma (Ginnania) nebula lævigatum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 376, pl. xcvii, figs. 3—5.

Specific Characters.—Shell spindle-shaped, fairly solid; whorls slightly convex, generally constricted above, the last more than half the total length, with a thickened rim below the suture; ornamented by strong, but not very prominent longitudinal ribs as wide as the spaces between them, which die out towards the base of the shell, and by very fine spiral lines, the upper whorls being smooth; spire gradually tapering to a fine point; mouth oval, acutely angulate above; outer lip gently curved, more or less continuous with a very short and rather wide canal; labial notch indistinct, basal notch conspicuous outside.

Dimensions.—L. 12—15 mm. B. 4—5 mm.

Distribution.—Recent: British coast, south and west, West Atlantic Cherbourg to Gibraltar, Azores, Mediterranean as far east as Alexandria, Adriatic, Ægean.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley. Butleyan: Butley.

Upper Pliocene: Biot, Altavilla. Pleistocene: Ficarazzi.

Remarks.—This southern form, ranging also into the English Channel and the west of Ireland, has been regarded of late years as a variety of *R. nebula*. I venture, however, to revert to the opinion of Jeffreys and other writers in considering it worthy of specific rank. The shell described by Wood in 1848 (Mon. Crag Moll., pt. i, p. 62, pl. vii, fig. 12) as *Clavatula lævigata*? was afterwards referred by him to *R. tenuistriata*, A. Bell, a different species which, as already stated (p. 263), is rather common in the Waltonian deposits. I have some Recent Mediterranean specimens of *R. lævigata* received from M. Dautzenberg, all of which show a spiral rim thickened below the suture, which the longitudinal costæ do not cross. Jeffreys gives this as a characteristic feature of the present form. In the shell described by Wood in his 1st Supplement as *P. lævigata*,[1] as well as in some similar specimens I have obtained at Oakley, the costæ are continuous, and there is no sign of the marginal rim, nor does there seem to be in Philippi's original figure. Whether the Oakley shells may be regarded as the Crag equivalent of *R. lævigata* may perhaps be an open question. Meanwhile I figure one of them provisionally under that name. I have given also two specimens of the Recent shell received from M. Dautzenberg, for the use of collectors, and to draw

[1] *Op. cit.*, p. 42, pl. vi, fig. 15.

attention to the subject. One of them (Pl. XXX, fig. 35) is the type form, the other, smaller and more slender (fig. 36), the var. *minor* of Jeffreys. The Crag shell (fig. 37) resembles the latter.

Genus **BELA** (Leach) Gray, 1847.

Bela turricula (Montagu). Plate XXXII, figs. 7—11.

1803. *Murex turricula*, Montagu, Test. Brit., pt. i, p. 262, pl. ix, fig. 1.
1853. *Mangelia (Bela) turricula*, Forbes and Hanley, Brit. Moll., vol. iii, p. 450, pl. cxi, figs. 7, 8.
1867. *Pleurotoma turricula*, Jeffreys, Brit. Conch., vol. iv, p. 395, pl. xci, fig. 7.
1870. *Mangelia turricula*, S. V. Wood, jun., and F. W. Harmer, Rep. Brit. Assoc. (Liverpool), p. 90.
1888. *Pleurotoma turricula*, A. Bell, Rep. Brit. Assoc. (Bath), p. 136.
1912. *Bela turricula*, Dautzenberg et Fischer, Camp. Scient. Pr. Monaco, vol. xxxvii, p. 41.

Specific Characters.—Shell solid, oblongo-fusiform, spire remarkably turreted, elongate, gradually tapering to a truncated point; whorls but slightly convex, strongly and squarely angulated, with a narrow step-like shelf below the suture, the last longer than the spire; suture not deep but well defined by a wavy line; ornamented by strong longitudinal ribs, rather prominent, slightly tuberculate on the keel, straight below the shelf, curved on the last whorl, extending to the suture and mouth, but not always to the base of the shell; except the apex, which is smooth, the surface is covered with well-marked regular, equal and equidistant spiral striæ (well shown in my fig. 7); mouth oblong, angulated by the keel; canal short, wide, ending in a rounded notch; outer lip angular above, not expanded.

Dimensions.—L. 15—20 mm. B. 5—8 mm.

Distribution.—Recent: coasts of Great Britain and Ireland, Shetland (Jeffreys). Denmark (Nordmann). Heligoland (Frey). Cherbourg (De Gerville). Boulonnais (Bouchard-Chantereaux).

Fossil: Butleyan Crag: Bawdsey, Hollesley, Butley. Icenian—Norwich zone: Bramerton, Thorpe, near Norwich, Yarn Hill, Beccles, probably elsewhere. Weybourne zone: Weybourne. Isle of Man, Wexford gravels.

Pleistocene: Middle glacial sands of Billockby; Bridlington, March, Selsey, Portland, Torbay, Scotland, Ireland.

Remarks.—The term "*Bela*" is now used for a distinct genus of small fusiform shells with a northern or Arctic range, having an elongate and turreted spire, a short canal, a flattened columella, a thin outer lip, the labial sinus being wanting or nearly so; of these, the British but not Arctic form *B. turricula*, has been taken as the type; the latter, however, forms no part of the group of specially northern

forms described by Scandinavian geologists, which, with the exception of *B. Trevelyana*, are unknown in British seas.

When Wood's Monograph was written in 1848—50, the Arctic Belas were but little known in this country. Authors like Möller did not figure, and but imperfectly described the various forms noticed for the first time in their writings, and regarded by them as specifically distinct. Wood had, therefore, no alternative but to group the few specimens of *Bela* which came under his notice as *B. turricula*.

Jeffreys, moreover, as late as 1867, adopted a similar view, and much confusion has arisen in consequence. When the latter says, for example (*op. cit.*, p. 397), that *B. turricula* occurs in Greenland or Spitzbergen, he creates a wrong impression; he is really referring to Scandinavian and Arctic forms like *B. nobilis*, *B. scalaris*, or *B. exarata*, which in the context he associates with it. To this day, unfortunately, the confusion continues; many such Crag Belas may be still found in our museums and in private collections under the former name, and lists of Crag Mollusca often contain the name of *B. turricula;* but such lists cannot be relied on.

It should be noted, however, that Prof. Kobelt, and more recently MM. Dautzenberg and H. Fischer, have proposed to regard many of the northern Belas referred to in the sequel as varieties of *B. turricula;* but with all the respect due to such authorities, I doubt whether this is desirable.[1] The most of them are now characteristic denizens of polar seas, ranging but little to the south of the Arctic circle. On the other hand, there is no evidence to show that the typical *B. turricula* was in existence in the North Sea at the beginning of the Red Crag period. I have not met with it at Oakley, and, as far as I know, it is exceedingly rare at later horizons of the Crag, though it occurs occasionally in the Manx beds and in the Wexford gravels. As a characteristic form, however it belongs to the Pleistocene rather than to the Pliocene deposits, being apparently one of the latest of the Belas to establish itself in any abundance in the Crag basin.

After all, nomenclature is to a great extent a matter of convenience. We no longer think, as in pre-Darwinian days, that species are separated by an impassable barrier, each having had its specially created progenitor. It appears rather absurd to a geologist, though perhaps not to a zoologist, to place what seems to have been a comparatively recently developed form *in loco parentis* to a group of species which were probably numerous and wide-spread long before their suggested ancestor or prototype had come into existence, especially as many of these well-marked northern forms show a continuity of existence from Waltonian times to the present day.

Mr. Friele takes a somewhat similar view. Protesting against the grouping

[1] I cannot regard Prof. Kobelt's figure of *B. turricula* (*op. cit.*, vol. iii, pl. lxxxii, fig. 1) as typical of the Recent British shell; indeed, he identifies it with *B. rugulata*.

of some of the Arctic Belas by Jeffreys with *B. turricula*, he agrees with Troschel and Prof. G. O. Sars that the latter is "perfectly different,"[1] and cannot be regarded as a parent form. He does not even group them with *B. rugulata*, to which he thinks they have a closer affinity, because he is desirous of elucidating their geographical distribution. In the following pages I propose to regard these northern forms as specifically distinct, under the names generally adopted by Scandinavian conchologists.

I doubt whether any of the specimens figured by Wood as *B. turricula* represent the typical British species, and I am not aware that any verified specimens of the latter have been reported from polar seas.[2]

It seems to me that *B. turricula* may be regarded as a distinct species, which may be easily distinguished from the northern Belas, differing from them, both in form and sculpture, more widely than some of them, regarded as specifically different, do from each other.

Bela scalaris (Möller). Plate XXXI, figs. 1—4.

1841–70. *Fusus turricula*, Gould, Rep. Inv. Mass., ed. 1, p. 292, fig. 193, 1841; *Bela turricula*, ed. 2, p. 351, fig. 620, 1870.
1842. *Defrancia scalaris*, Möller, Ind. Moll. Groenl., p. 12.
1872. *Pleurotoma scalaris ?*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 39, pl. iii, fig. 12.
1878. *Bela scalaris*, G. O. Sars, Moll. Reg. Arct. Norv., p. 229, pl. xxiii, fig. 5.
1886–1901. *Bela scalaris*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 6, pl. vii, figs. 10, 11; pl. ix, figs. 16—20, 1886; vol. iii, p. 89, 1901.
1887. *Bela scalaris*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 161, pl. xxxiii, fig. 1.
1893. *Pleurotoma scalaris*, A. Bell, Proc. Roy. Phys. Soc. Edin., vol. xii, p. 22.
1899. *Bela nobilis*, var. *scalaris*, Posselt, Medd. om. Grönl., vol. xxiii, p. 149.
1905. *Bela turricula scalaris*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 239, pl. lxxxii, figs. 10, 11.
1912. *Bela turricula*, var. *scalaris*, Dautzenberg et Fischer, Camp. Scient. Pr. Monaco, vol. xxxvii (Mollusques), p. 42.

Specific Characters.—Shell solid, turreted, sub-fusiform; whorls 7—8, slightly convex, regularly tapering, the last about two-thirds the total length, strongly angulated, with a sloping shelf below the suture; ornamented by about twenty longitudinal costæ, not very prominent, narrower than the spaces between them, slightly nodulous on the keel, obliquely continuous upon the shelf, as well as by

[1] Norske Nordh. Exped. (Mollusca), pt. ii, p. 7, 1886.

[2] The name of *B. turricula* occurs in a MS. list of Walton fossils compiled by the late R. G. Bell and Prof. Kendall many years ago. At that time all the Crag Belas were included under that name, as stated above, and as, indeed, is still largely the case. I know of no evidence to show that the typical *B. turricula* occurs at Walton.

numerous fine and wavy spiral ridges, closely crowded together, the upper one forming a distinct and prominent margin to the whorls; spire scalariform, elongated, longer in proportion to the breadth of the shell than in *B. nobilis*; suture well marked, rather oblique; mouth oval, nearly as long as the spire; outer lip thin, regularly curved, angulated by the keel, ending in a short and open canal.

Dimensions.—L. 15—25 mm. B. 8—10 mm.

Distribution.—Recent: Bergen (Norman), Finmark, Lapland, Lofoten Islands, Kola, Kara Sea, Nova Zembla, Siberian coast, Spitzbergen, Iceland, Greenland, North-eastern America to Cape Cod.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Sutton, Waldringfield. Butleyan: Butley. Icenian: Bramerton; probably at other Crag localities. Isle of Man.

Pleistocene: Bridlington, March gravels (F. W. H.), King Edward (A. Bell). Murman coast.

Remarks.—This is one of the most characteristic of the Arctic Belas, having a wide circumpolar range, but not being reported to the south of Bergen. As just stated, it is considered by some authorities a variety of the British *B. turricula*, from which it differs materially in form and ornamentation, but by Posselt as specifically allied to *P. nobilis*, another Arctic and non-British shell which it approaches more nearly.

It is distinguished from the latter by its somewhat finer and less prominent sculpture, its comparatively elongate spire, its more oblique suture, and the more sloping character of the shelf below it.

The specimen described by Gould (Rep. Inv. Mass., ed. 1, p. 292, fig. 193, and ed. 2, p. 351, fig. 620) as *Fusus turricula* is possibly the present form; it does not appear to be the British species known under the latter specific name.

Prof. G. O. Sars' typical figure of *B. scalaris* is 26 mm. in length, with an elongate spire and fine, closely-set spiral sculpture, represented in the Crag by Pl. XXXI, fig. 1, of the present Memoir. On the other hand, Prof. Leche gives a smaller variety (B), 9 mm. long, which he says corresponds with that originally described by Möller. I have figured a similar Recent one (fig. 3), together with one from Oakley with which it agrees (fig. 4). The smallest specimen (fig. 5), from the same locality, may be *B. rugulata.*

The *P. robusta* of Wood (1st Suppl., pt. i, pl. iii, fig. 16) may perhaps be a variety of *B. scalaris.* I had a specimen very similar to that figured by him (one of those lost in the post, see p. 282) which Dr. Odhner had identified with the present species.

Mr. Friele states (*op. cit.*) that *B. scalaris* was dredged by the Norwegian Expedition at various localities from a depth of from 123 to 223 fathoms. It seems to be one of the most common of the Belas found in the Crag.

Most of the fossil specimens of *Bela* here represented have been identified by

one or another of the Scandinavian authorities mentioned on p. 2 of the first part of this Memoir, to whom I again offer my thanks for their assistance. For the loan of the Recent shells figured with them I am indebted to the kindness of Prof. Lönnberg and Dr. Odhner, of the Zoological Museum at Stockholm.

Var. **ecarinata**, G. O. Sars. Plate XXXI, figs. 6—8.

1878. *Bela scalaris*, var. *ecarinata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 229, tab. xvi, fig. 9.
1886. *Bela scalaris*, var. *ecarinata*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 6, pl. vii, fig. 9.
1893. *Pleurotoma scalaris*, var. *ecarinata*, A. Bell, Proc. Roy. Phys. Soc. Edin., vol. xii, p. 22.

Varietal Characters.—Smaller and more slender than the type, with finer sculpture and more numerous costæ; the upper part of the whorls is rounded or but slightly carinate.

Dimensions.—L. 10—15 mm. B. 4—6 mm.

Distribution.—Recent: northern Seas, west Finmark.

Fossil: Waltonian Crag: Little Oakley. Butleyan: Butley.

Pleistocene: King Edward (A. Bell).

Remarks.—Prof. Sars says this variety is easily distinguished from the type by its less solid character, narrower form, and its regularly convex and non-carinate whorls. In one of the specimens from Stockholm here figured, which has been identified by Dr. Odhner, the carination is not wholly obsolete.

Var. **abyssicola**, Friele. Plate XXXI, figs. 9, 10.

1886. *Bela scalaris*, var. *abyssicola*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 6, pl. vii, figs. 12, 13; pl. ix, fig. 21.
1893. *Pleurotoma scalaris*, var. *abyssicola*, A. Bell, Proc. Roy. Phys. Soc. Edin., vol. xii, p. 22.
1905. *Bela turricula scalaris*, var. *abyssicola*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 240, pl. lxxxii, figs. 17—18.

Varietal Characters.—This form differs from the type, as does the variety *ecarinata*, in its finer sculpture. Judging from a Recent specimen, however, figured with that from the Crag, and the figures of the authorities before quoted, the variety *abyssicola* is less slender and more distinctly keeled than the last-named variety.

Dimensions.—L. 12—18 mm. B. 5—8 mm.

Distribution.—Recent: north-western coasts of Norway to Bear Island (Friele), Greenland (Möller), New England coast (Verrill), Kara Sea (Leche).

Fossil: Newbournian Crag: Sutton. Butleyan: Butley.

Pleistocene: King Edward (A. Bell).

Remarks.—The Recent specimen here figured, with which the Crag fossil has been identified, is from the Stockholm Museum.

Bela nobilis (Möller). Plate XXXI, figs. 17—21.

1842. *Defrancia nobilis*, Möller, Ind. Moll. Groenl., p. 12.
1878. *Bela nobilis*, G. O. Sars, Moll. Reg. Arct. Norv., p. 228, pl. xvi, figs. 19, 20.
1884. *Bela nobilis*, Mörch and Poulsen, MS. list in Geological Museum, Copenhagen, no. 36 (unpublished).
1886–1901. *Bela nobilis*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 5, pl. vii, fig. 8, 1886; pt. iii, p. 88, 1901.
1887. *Bela nobilis*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 145, pl. xxxi, fig. 10.
1890. *Bela nobilis*, A. Bell, Rep. Brit. Assoc. (Leeds), p. 410.
1893. *Bela nobilis*, A. Bell, Proc. Roy. Phys. Soc. Edin., vol. xii, p. 22.
1899. *Bela nobilis*, Posselt, Medd. om Grönl., vol. xxiii, p. 147.
1901. *Bela nobilis* (*rugulata*), Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 653, pl. vi, fig. 14.
1905. *Bela turricula nobilis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 237, pl. lxxxii, fig. 4.
1910. *Bela nobilis*, Odhner, Kongl. Svensk. Vet-Akad. Handl. Stockholm, vol. vii, p. 12.
1911. *Bela nobilis*, Øyen, Contr. Quart. Geol. Norw. (Arch. Math. Naturvid., vol. xxxii), p. 4.

Specific Characters.—Shell solid, ovato-fusiform; spire turreted, shorter in comparison to the length than in *B. scalaris;* apex acute; whorls 7—8, squarely angulate, with a flattened shelf below the suture, the last expanded, much the largest, two-thirds the total length; ornamented by 16—20 strong and prominent longitudinal ribs, nodulous on the keel, intersected by fine undulating spiral ridges, the uppermost, stronger than the others, forming a continuous margin to the whorls; suture less oblique than in *B. scalaris;* mouth ovate, about half the length of the shell, distinctly angulated by the keel; canal wide, truncated.

Dimensions.—L. 12—25 mm. B. 6—12 mm.

Distribution.—Recent: Tromsö, Hammerfest, Lofoten Islands, Murman Coast, White Sea, Arctic Siberia, Nova Zembla (Leche), Kara Sea, eastern North America; Behring Strait (Friele), Greenland, Iceland (Odhner).

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley. Newbournian: Waldringfield. Butleyan: Butley, Iceland Crag. Isle of Man, Wexford.

Pleistocene: March gravels (F. W. H.); Clava, King Edward (A. Bell); Christiania region—Yoldia-clays, Arca-clay, Scrobicularia- and Tapes-banks (Brøgger); Trondhjem (Øyen); Spitzbergen (Knipowitsch).

Remarks.—This form is usually considered specifically distinct from *B. scalaris*, to which, however, it is closely allied. As stated above, it may be distinguished from the latter by its less elongate spire, its stronger sculpture, and the more distinct and squarer carination of its whorls.

Prof. G. O. Sars has figured two varieties, one of which, smaller and wider in

proportion, he considered immature. I have found both forms in the Crag, but my specimen of the larger kind, after having been identified at the Stockholm Museum, was unfortunately lost in the post with some other Oakley Belas on its way back.[1] Those of the smaller type, now figured, from Boyton, Oakley, and Butley, agree with a Recent specimen from Iceland. A similar fossil was found at Cranstal in the Isle of Man by the Rev. S. N. Harrison.

B. nobilis appears in Mörch and Poulsen's MS. list of Mollusca from the Crag of Iceland, and Mr. A. Bell found it some years ago in the Pleistocene deposits of King Edward in Banffshire, in N.E. Scotland, and at Clava in the Nairn Valley.

Like *B. scalaris* it is a distinctly circumpolar form, with a range almost exclusively to the north of the Arctic circle. Mr. Friele states that in the Norwegian North Atlantic Expedition it was found only at Hammerfest and Tromsö, and not far from the coast.

Bela rugulata, Troschel. Plate XXXI, figs. 5, 11, 12.

1866. *Bela rugulata* (Möller), Troschel, Geb. Schneck., vol. ii, p. 44, pl. iv, fig. 6.
1878. *Bela rugulata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 230, pl. xxiii, fig. 6.
1884. *Bela rugulata*, Mörch and Poulsen, MS. list in Geological Museum, Copenhagen, no. 37 (unpublished).
1886. *Bela rugulata*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 3, pl. vii, figs. 1—7.
1887. *Bela rugulata*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 143, pl. xxxi, fig. 7.
1905. *Bela turricula rugulata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 239, pl. lxxxii, figs. 6—9, 14—16.
1910. *Bela rugulata*, Odhner, Kongl. Svensk. Vet-Akad. Handl. Stockholm, vol. vii, p. 11.

Specific Characters.—Shell carinated, ovato-fusiform; whorls 6—7, the last ventricose, about two-thirds the total length, sharply angulated by the keel, with a sloping shelf below the suture; spire short, rapidly diminishing; apex twisted, ending in a blunt and rounded point; ornamented by well-marked longitudinal ribs, intersected by fine, unequal spiral ridges which are slightly thickened where they cross the ribs, that on the keel being nodular, continuous and thicker than the others; mouth oblong, ending in a short and rather wide canal; outer lip strongly angulated; columella flexuous.

Dimensions.—L. 12 mm. B. 7 mm.

Distribution.—Recent: Christiania Fiord to Finmark; Iceland, Greenland.

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley, Isle of Man? Pleistocene: March gravels.

Pliocene: Iceland. Pleistocene: Christiania Fiord.

Remarks.—One or two specimens from Oakley which had been identified as

[1] This parcel was traced as far as Berlin, to which it had been mis-sent. The chance of its turning up again is not promising.

B. rugulata were unfortunately among those that were lost in the post. I have figured a specimen from Boyton together with a Recent shell from the Stockholm Museum, which Dr. Odhner considers typical, for comparison with it. Mr. A. Bell has noticed among some fossils obtained from the Manx drift by the Rev. S. N. Harrison one or two others, imperfect, which may be referred, I think, to this species.

B. rugulata is not such a decidedly northern form as some of the Belas here described, having been found as far south as the Christiania Fiord, although it has been reported also from Iceland and Greenland. Mr. Friele says it occurs along the entire Norwegian coast as far north as Tromsö and Hammerfest in from 10 to 197 fathoms.

Prof. Brøgger regards it as a variety of *B. nobilis*, and Dr. Kobelt of *B. turricula*, but Prof. G. O. Sars, Mr. Friele, Drs. Nordgaard, Sparre Schneider, Odhner and others, whom I follow, consider it specifically distinct.

B. rugulata belongs to the same group as *B. scalaris* and *B. nobilis;* the spiral sculpture of the former, however, is different, as is the dentition of the mollusc.

Var. **scalaroides,** G. O. Sars. Plate XXXI, figs. 13, 14.

1878. *Bela scalaroides,* G. O. Sars, Moll. Reg. Arct. Norv., p. 231, pl. xxiii, fig. 7.
1886. *Bela rugulata,* var. *scalaroides,* Friele, Norske Nordh. Exped. (Mollusca), vol. ii, p. 5, pl. vii, fig. 7.
1887. *Bela scalaroides,* Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 158, pl. xxxii, fig. 12.
1893. *Pleurotoma scalaroides,* A. Bell, Proc. Roy. Phys. Soc. Edinb., vol. xii, p. 22.
1905. *Bela turricula scalaroides,* Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 240, pl. lxxxii, fig. 19.
1910. *Bela rugulata,* var. *scalaroides,* Odhner, Kongl. Svensk. Vet-Akad. Handl. Stockholm, vol. vii, p. 11.

Varietal Characters.—Shell more slender and elongate than the type; spiral sculpture regular and much finer; whorls less sharply angulate; spire longer than the mouth; mouth narrower; outer lip but little expanded.

Dimensions.—L. 15 mm. B. 7 mm.

Distribution.—Recent: Finmark, Lofoten Islands, North Cape, south of Bear Island, Iceland.

Fossil: Waltonian Crag: Little Oakley. Butleyan: Hollesley. Iceland Crag. Pleistocene: King Edward.

Remarks.—This shell was originally regarded by Prof. G. O. Sars as specifically distinct, but has been since considered by Mr. Friele and Dr. Odhner as a variety of *B. rugulata.* The latter informs me it may be specially distinguished by its very fine spiral sculpture. I had an identified specimen from Oakley (one of

those lost) in which the transverse lines were somewhat coarser than in the type; in the imperfect example here figured, agreeing as far as it goes with a Recent shell from Stockholm, they are equally fine.

Mr. Friele says that the dental structure of the animal shows clearly its relation to *B. rugulata*, though its elongate spire is conspicuously different. The Recent shell is said by Prof. Sars to reach 23 mm. in length.

Var. **Schneideri,** nov. Plate XXXI, figs. 15, 16.

Varietal Characters.—Differs from the type in its more slender and elongate spire, its less expanded body-whorl, and especially in the coarseness of its sculpture, both longitudinal and transverse, which is more or less tuberculate at the points of intersection.

Dimensions.—L. 12—15 mm. B. 5—6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley. Newbournian: Waldringfield, Sutton. Butleyan: Hollesley, Butley. Icenian: Bramerton; probably elsewhere in the Crag.

Pleistocene: March gravels.

Remarks.—The present seems a very distinct form, not very rare in the Crag, differing, especially in its strong and often tuberculate sculpture, from any species of *Bela* hitherto described, either Recent or fossil.

It departs from the type of *B. rugulata* in its more slender and elongate spire, which approaches that of *B. turricula;* in that species, however, the spiral sculpture is finer and more uniform. The body-whorl is never expanded or tumid as in the former, the upper whorls diminishing gradually so as to form a turreted, regularly tapering and attenuated cone. The spiral ridges of the present form are strong and closely crowded together, becoming tuberculate, forming a well-marked band on the keel, the tuberculations ceasing, however, towards the base of the shell. At first I was disposed to regard it as specifically distinct, but most of my Scandinavian friends consider it a variety of *B. rugulata*, a view which I now adopt, especially as I have lately received from Dr. Nordmann a Recent specimen from Iceland of an intermediate character, to some extent connecting the two forms.

Var. **bergensis,** Friele. Plate XXXI, figs. 22, 23.

1886. *Bela rugulata*, var. *bergensis*, Friele, Norske Nordh. Exped. (Mollusca), vol. ii, p. 4, pl. vii, figs. 5, 6.

1910. *Bela rugulata*, var. *bergensis*, Odhner, Kongl. Svensk. Vet-Akad. Handl. Stockholm, vol. vii, p. 11.

Varietal Characters.—Differs from the type form in its smaller size, in the greater length of the spire which is somewhat longer than the mouth, and in its more numerous longitudinal ribs; the apex is obtusely rounded.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution.—Recent: Norwegian coast: Sognefiord, Bergen, in 100 fathoms, Molde. Arnanes, Iceland (25 fathoms).

Fossil: Icenian Crag: Bramerton.

Remarks.—This variety was known to Mr. Friele from a limited area only, and not further north than Molde, but Dr. Odhner has recently reported it from Iceland. It is interesting to find in the English Crag, not only so many species of *Bela* now living in northern seas, but also well-marked varieties of them which still exist in those regions. For the identification of the present specimen I am indebted to Dr. Odhner; the Recent Icelandic shell figured with it is from the Stockholm Museum. Mr. Friele states that Jeffreys regarded this form as a distinct species.

Bela exarata (Möller). Plate XXXI, figs. 32, 33.

1842. *Defrancia exarata*, Möller, Ind. Moll. Groenl., p. 12.
1870. *Mangelia exarata*, S. V. Wood, jun., and F. W. Harmer, Rep. Brit. Assoc. (Liverpool), p. 90.
1878. *Bela exarata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 232, pl. xvi, fig. 18.
1884. *Pleurotoma exarata*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 320.
1886-1901. *Bela exarata*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 19, pl. viii, fig. 24, 1886; pt. iii, p. 89, 1901.
1887. *Bela exarata*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 140, pl. xxxi, fig. 4.
1890. *Pleurotoma exarata*, A. Bell, Rep. Brit. Assoc. (Leeds), p. 410.
1899. *Bela exarata*, Posselt, Medd. om Grönl., vol. xxiii, p. 146.
1905. *Bela turricula exarata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 236, pl. lxxxii, fig. 3.
1910. *Bela exarata*, Odhner, Kongl. Svensk. Vet-Akad. Handl. Stockholm, vol. vii, p. 12.

Specific Characters.—Shell rather small, ovato-fusiform, turreted; whorls 6, but little convex, angulate above, the last about two-thirds the total length, excavated below, with a narrow and sloping shelf under the suture; ornamented by numerous longitudinal ribs hardly reaching the canal, equal to the spaces between them, and becoming slightly nodulous on the keel, as well as by raised and wavy spiral ridges, the upper one more or less continuous, the shell having a reticulate appearance; suture well-marked; spire short, with a blunt apex, mouth oval, angulated by the keel; outer lip but little expanded; columella flexuous.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution—Recent: Tromsö, Hammerfest, Alten Fiord, near the coast in 10

to 30 fathoms (Friele), Lofoten Islands, Kara Sea, Siberian coast, Spitzbergen, Iceland, Greenland, Labrador.

Fossil : Waltonian Crag: Little Oakley. Icenian: Bramerton, Postwick. Wexford gravels.

Pleistocene: Bridlington, March, Middle Glacial sands of Billockby; Labrador, Spitzbergen, Greenland (Posselt).

Remarks.—This small northern and Arctic species has not been recorded hitherto from the Crag. I obtained a single specimen from Oakley, and it has also been found at Bramerton. The Recent shell figured with the Crag fossil is from the Stockholm Museum. *B. exarata* has been considered by Jeffreys, Prof. Kobelt and some others as a variety of *B. turricula*, but it is regarded generally by Scandinavian conchologists, and I think with reason, to be a distinct species. As before stated, the typical *B. turricula* is not known to me from the lower horizons of the English Crag.

Bela mitrula (Lovén). Plate XXXI, figs. 30, 31.

1846. *Tritonium mitrula*, Lovén, K. Svensk. Vet.-Akad. Forh., vol. iii, p. 85.
1878. *Bela mitrula*, G. O. Sars, Moll. Reg. Arct. Norv., p. 233, pl. xxiii, fig. 9.
1887. *Bela mitrula*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 158, pl. xxxii, fig. 13.
1896. *Bela exarata*, var. *mitrula*, Sparre Schneider, Tromsoe Mus. Aārsh., vol. ix, p. 29.
1905. *Bela turricula mitrula*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 241, pl. lxxxii, fig. 12.

Specific Characters.—Shell small or minute, ovato-fusiform, turreted, rather thin; whorls 6—7, strongly carinated, with a well-marked shelf below the suture; ornamented by numerous longitudinal costæ which die out on the body-whorl, and by spiral ridges—the upper one continuous, their intersection with the ribs giving the shell a cancellate appearance—with slight granulations, especially on the keel; suture deep; mouth short, rather wide, angulated above and by the keel; canal open, very short.

Dimensions.—L. 8—12 mm. B. 4—6 mm.

Distribution.—Recent : Norwegian coast, Finmark, Lofoten Islands.

Fossil : Icenian Crag: Bramerton.

Remarks.—This form, regarded by Mr. Friele as identical with *B. exarata* and by Dr. Sparre Schneider and others as a variety of that species, was known to Prof. G. O. Sars from the Norwegian coast, but not from any locality further north than Vardö or Hammerfest. The specimen from the Icenian Crag of Bramerton now figured, which belongs to the Norwich Museum, appears to correspond with a Recent shell I received from Canon Norman. Both of these are smaller than that described by Prof. Sars.

Bela harpularia (Couthouy). Plate XXXII, figs. 14, 15.

1838. *Fusus harpularius*, Couthouy, Boston Journ. Nat. Hist., vol. ii, p. 106, pl. i, fig. 10.
1841-70. *Bela harpularia*, Gould, Rep. Inv. Mass., ed. 1, p. 291, fig. 191, 1841; ed. 2, p. 352, fig. 621, 1870.
1871. *Bela harpularia*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 357.
1878. *Bela harpularia*, G. O. Sars, Moll. Reg. Arct. Norv., p. 234, pl. xvi, fig. 17.
1882. *Bela harpularia*, Verrill, Trans. Conn. Acad., vol. v, p. 473, pl. xliii, fig. 14 *b*; pl. lvii, fig. 9.
1890–3. *Pleurotoma harpularia*, A. Bell, Rep. Brit. Assoc. (Leeds), p. 410, 1890; Proc. Roy. Phys. Soc. Edinb., vol. xii, p. 22, 1893.
1899. *Bela harpularia*, Posselt, Medd. om Grönl., vol. xxiii, p. 144.
1905. *Bela harpularia*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 243, pl. lxxxii, fig. 21.
1910. *Bela harpularia*, Odhner, Kongl. Svensk. Vet.-Akad. Handl. Stockholm, vol. vii, p. 11.

Specific Characters.—Shell ovato-fusiform; whorls 6, somewhat convex, distinctly but obtusely carinate, with a narrow sloping shelf below the suture, the last two-thirds the total length; ornamented by about sixteen to eighteen inconspicuous longitudinal ribs, hardly reaching the base of the shell, slightly tuberculate on the keel, and by excessively fine spiral ridges, closely crowded together; suture slight; mouth ovate, contracted below, ending in a short and open canal.

Dimensions.—L. 14 mm. B. 6 mm.

Distribution.—Recent: western and northern coasts of Norway; Finmark, Lofoten Islands, Iceland, White Sea, Nova Zembla, Kara Sea, Siberian coast, Behring Sea, Greenland, east coast of North America.

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley. Newbournian: Waldringfield. Butleyan: Butley (A. Bell). Wexford, Isle of Man.

Pleistocene: Bridlington; King Edward, Banffshire. Norway, Murman coast.

Remarks.—This form is considered by most conchologists to be a distinct species, agreeing with the Recent North American shell *B. harpularia*. It approaches *B. turricula* more nearly than some of the Belas before described, and Mr. Friele, while admitting it to be in all essentials coincident with the American form, remarks it may possibly be a local variety of the latter. They are easily distinguished, however, and as in view of the fact mentioned above that *B. turricula* belongs to the upper zones of the Crag, and is a characteristic British form, while the other, unknown in British seas, is characteristically northern, I agree with those who consider they should be kept specifically separate. Mr. Friele states that *B. harpularia* was dredged by the Norwegian Expedition at Bodö, Tromsö and Hammerfest in 10—30 fathoms, but that it is distributed also along the west and north coasts of Norway, beginning at Christiansund, as well as in the regions given above.

I have received two Recent specimens from Stockholm, one of which has a larger number of longitudinal costæ than the other. The fossil from Boyton, here

figured, agrees in this respect with the first; another which I have received from the Isle of Man, with the second.

Var. **rosea** (Lovén). Plate XXXII, figs. 16, 17.

1846. *Tritoneum roseum* (M. Sars, MS.), Lovén, K. Svensk. Vet-Akad. Forh., vol. iii, p. 84.
1867. *Pleurotoma turricula*, var. *rosea*, Jeffreys, Brit. Conch., vol. iv, p. 396.
1878. *Bela harpularia*, var. *rosea*, G. O. Sars, Moll. Reg. Arct. Norv., p. 234, pl. xxiii, fig. 10.
1905. *Bela turricula rosea*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 238, pl. lxxxii, fig. 5.

Varietal Characters.—More slender and generally smaller than the type form of *B. harpularia*, and sometimes with a more elongate spire.

Dimensions.—L. 8—10 mm. B. 3—4 mm.

Distribution.—Recent: Great Britain—Oban (Jeffreys); Norwegian coast—Christiansund to Tromsö, Lofoten Islands.

Fossil: Coralline Crag: Boyton.

Remarks.—Dr. Odhner has kindly sent me a Recent specimen under this name, dredged near Bodybet in 20 fathoms, for comparison, with which some fossils collected by Mr. W. M. Crowfoot at Boyton, agree. Dr. Odhner speaks of it as a small variety. He has identified a larger shell from the same locality, which he says is the same. The Recent form is generally rose-coloured.

Bela multistriata (Jeffreys). Plate XXXII, fig. 29.

1884. *Pleurotoma multistriata*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 321, pl. xv, fig. 4.
1899. *Bela multistriata*, Posselt, Medd. om Grönl., vol. xxiii, p. 163.

Specific Characters.—Shell oval, minute, strong; whorls 4—5, convex, abruptly enlarging, the last two-thirds the total length; ornamented by numerous, closely-set and excessively-fine spiral striæ, intersected by faint lines of growth and an occasional varix; spire short, turreted; apex bulbous; suture deep; mouth oval, rather wide, angulated above; inner lip forming a broad glaze on the pillar; labial notch small and shallow.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Recent: Greenland.

Fossil: Bridlington drift.

Remarks.—Through the kindness of Mr. W. B. Headley, of Stamford, I am able to figure one of Jeffreys' type specimens of this charming little shell. There are four specimens of it in Mr. Headley's collection in one box labelled, in Jeffreys' well-known writing, *Pleurotoma multistriata*. It seems to be a distinct form,

unlike anything described in the recent conchological works that are accessible to me.

Posselt quotes Jeffreys' opinion, " Litora Groenlandiæ subfossilis tantum notæ," but I cannot find the reference.

Bela decussata (Couthouy). Plate XXXI, figs. 24—26.

1839. *Pleurotoma decussata*, Couthouy, Boston Journ. Nat. Hist., vol. ii, p. 183, pl. iv, fig. 8.
1841–70. *Bela decussata*, Gould, Rep. Inv. Mass., ed. 1, p. 280, fig. 185, 1841; ed. 2, p. 354, fig. 623, 1870.
1842. *Defrancia viridula*, Möller, Ind. Moll. Groenl., p. 14.
1884. *Pleurotoma decussata*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 320.
1886–1901. *Bela decussata*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 12, pl. viii, figs. 12, 13; pl. x, figs. 12, 13, 1886; pt. iii, p. 91, 1901.
1887. *Bela decussata*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 153, pl. xxxii, fig. 6.
1899. *Bela decussata*, Posselt, Medd. om Grönl., vol. xxiii, p. 152.
1905. *Bela decussata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 252, pl. lxxxiii, figs. 20, 21.
1910. *Bela decussata*, Odhner, Kongl. Svensk. Vet-Akad. Handl. Stockholm, vol. vii, p. 10.

Specific Characters.—Shell small, ovate, whorls convex, the last tumid; spire short, less than one-third the total length; ornamented with numerous sinuous and inconspicuous longitudinal ribs which do not reach the base, and by faint spiral striæ; suture clearly marked; mouth oval, angulate above; outer lip gently rounded; canal wide, very short; columella excavated.

Dimensions.—L. 8—12. B. 4—5.

Distribution.—Recent: Tromsö, Finmark, Iceland, Greenland, east coast of North America, Faroe Channel, Nova Zembla, Kara Sea, Spitzbergen, Arctic coasts of Siberia (Friele).

Fossil: Icenian Crag: Norwich zone—Bramerton; Weybourne zone—East Runton.

Pleistocene: Bridlington. Siberia.

Remarks.—The Crag specimens here represented are from the Fitch collection in the Norwich Museum and have been identified by Mr. Friele; in both of them the sculpture is almost obliterated. They differ in size and form, those from East Runton being much shorter in the spire than that from Bramerton or than in the North American shell described by Gould. For the Recent shell from Greenland I am indebted to Dr. Odhner. The Bridlington specimen, from the Headley Collection, is of the short-spired variety.

Var. **inflata,** Posselt. Plate XXXI, fig. 27.

1884. *Bela simplex*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 320.
1889. *Bela decussata*, var. *inflata*, Posselt, Medd. om Grönl., vol. xxiii, p. 154, pl i, fig. 4.

Varietal Characters.—Shell smaller than the type, with an inflated body-whorl and an exceedingly short spire.

Dimensions.—L. 7 mm. B. 4 mm.

Distribution.—*Recent :* Greenland.

Fossil : Bridlington.

Remarks.—In Mr. Headley's collection of Bridlington fossils, the most of which are unsorted, there are several specimens of *Bela* which were submitted to Jeffreys for identification and returned from him packed in separate boxes with the names of the species attached to which they had been referred. Among these there is one named in his own writing *B. simplex*, which was probably the example upon which the insertion of that species in his list of Bridlington Mollusca was based.

It differs materially, however, from the figures of *B. simplex* published by Prof. G. O. Sars and Kobelt, which are those of a larger shell, 18 mm. in length with a very wide and open canal, without longitudinal ornament, equivalent to *B. gigas*, Verkrüzen.

I am disposed to refer the shell in question to the variety *inflata* of *B. decussata* figured by Posselt, with which it seems to me accurately to correspond both in form and in its delicate sculpture. The fine longitudinal ribs are confined to the upper whorls, as in Posselt's figure.

Var. **conoidea**, G. O. Sars. Plate XXXI, figs. 28, 29.

1878. *Bela conoidea*, G. O. Sars, Moll. Reg. Arct. Norv., p. 236, pl. xvi, fig. 14.

1886–1901. *Bela decussata*, var. *conoidea*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 13, pl. viii, fig. 14, 1886; pt. iii, p. 91, 1901.

1905. *Bela decussata conoidea*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 259, pl. lxxxiii, fig. 13.

Varietal Characters.—Shell elongato-fusiform; longer and narrower than in the type; whorls but little convex; longitudinal ribs curved or oblique.

Dimensions.—L. 10—15 mm. B. 4—6 mm.

Distribution.—*Recent :* Finmark.

Fossil : Icenian Crag: Bramerton.

Remarks.—The Bramerton fossil here figured has been determined by Dr. Odhner, who has also kindly sent me a Recent specimen for comparison.

Originally described as a distinct species it has been more recently regarded by Mr. Friele, Dr. Sparre Schneider and others as a variety of *B. decussata*, with which species it is closely allied. At present it is only known in a living state from Finmark, near the coasts of which it has been dredged in 223 to 259 fathoms.

Bela Dowsoni (S. V. Wood). Plate XXXII, fig. 18.

1872. *Pleurotoma Dowsoni*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 39, pl. iii, figs. 13, 14.

Specific Characters.—Shell ovato-fusiform; whorls 6, convex, obtusely and squarely angulated above, the last tumid, much the largest, about two-thirds the total length; ornamented by numerous strong longitudinal costæ which do not reach the base of the shell, about twenty on the body-whorl, and by rather coarse, closely-set spiral ridges; spire short, turreted, regularly diminishing in size; suture deep; mouth oval, short, rather narrow; outer lip angulated by the keel; inner lip forming a distinct glaze on the pillar.

Dimensions.—L. 14 mm. B. 7 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Waldringfield. Butleyan: Butley. Icenian: Reydon near Southwold.

Pleistocene: Billockby; Bridlington.

Remarks.—This form, which differs from any of those described by Prof. G. O. Sars or Mr. Friele and from all the Recent specimens I have received from my Scandinavian correspondents, was reported by Wood from the Icenian Crag of Aldeby,[1] from Bridlington and from the Middle Glacial sands of Billockby near Yarmouth. It has been since found by Mr. Ogden at Waldringfield and by myself at Oakley. Wood remarks that *B. Dowsoni* approaches *B. exarata*. It is much larger, however, than that species, and the ornamentation is coarser. It may be distinguished also from *B. rugulata* or *B. nobilis* by its strong sculpture. All the specimens known to me from the various horizons of the Crag and from Billockby maintain the same general character, and may be, I think, easily recognized.

Bela gigantea (Mörch). Plate XXXII, fig. 24.

1869. *Pleurotoma* (*Bela*) *violacea*, var. *gigantea*, Mörch, Ann. Soc. Malac. Belg., vol. iv (Mémoires), p. 22, no. 33.

1871. *Pleurotoma violacea*, var. *gigantea*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 357.

1872. *Pleurotoma arctica ?*, S. V. Wood, Mon. Crag Moll., 1st Suppl., p. 45, pl. vi, fig. 9.

1878. *Pleurotoma violacea*, var. *gigantea*, Leche, Kongl. Svensk. Vet.-Akad. Handl. Stockholm, vol. xvi, p. 57, pl. i, fig. 19.

1887. *Bela violacea*, var. *gigantea*, Aurivillius, Vega Exped. Vet. Jakt., vol. iv, p. 348.

1899. *Bela violacea*, var. *gigantea*, Posselt, Medd. om Grönl., vol. xxiii, p. 158.

1901. *Bela gigantea*, Knipowitsch, Ann. Mus. St. Pétersbourg, vol. vi, p. 482.

[1] Mr. Crowfoot informs me that the specimen figured by Wood as from Aldeby was really found when digging a well at Reydon Hall near Southwold.

1905. *Bela bicarinata gigantea*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 263, pl. lxxxiv, figs. 20, 21.

1912. *Bela gigantea*, Dautzenberg et Fischer, Camp. Scient. Pr. Monaco, vol. xxxvii (Mollusques), p. 43, pl. i, figs. 1, 2.

Specific Characters.—Shell large, fairly solid, turriculate, ovato-fusiform; whorls 6, convex, somewhat flattened below the suture, the last much the largest, two-thirds the total length; finely striated spirally, with indistinct longitudinal plications, especially on the upper whorls; suture deep; spire short, ending in a blunt point; mouth ovato-elongate, acutely angulate above; outer lip gently curved but not expanded; canal open, truncated, very short; columella nearly vertical.

Dimensions.—L. 18 mm. B. 8 mm.

Distribution.—Recent: west Greenland, Wellington Channel, Labrador, Gulf of St. Lawrence, Iceland, N. of Hebrides, W. of Ireland, Norway, Bohuslan, Spitzbergen, Nova Zembla, Kara Sea, Behring Sea.

Fossil: Newbournian Crag: Waldringfield, Shottisham.

Remarks.—The fossil from Shottisham here figured, belonging to the York Museum, agrees with the shells originally described as a variety of *B. violacea*, but now regarded by M. Dautzenberg and others as specifically distinct. Mr. A. Bell believes it to be identical with some imperfect specimens he found forty years ago at Waldringfield, one of which, showing the body-whorl only, was figured by Wood in 1872 as *Pleurotoma arctica*, Adams, but with hesitation, as he had some doubt as to its specific connection with *B. violacea*. The Shottisham fossil is perfect, however, and is much larger than the dimensions of the type-form of the latter species given by Prof. G. O. Sars; it is rather worn, but it is possible with the aid of a lens to make out both the spiral lines and the faint longitudinal plication. It appears to agree very nearly with the specimen figured by Messrs. Dautzenberg and Fischer as *B. gigantea*.

Bela violacea (Mighels). Plate XXXII, figs. 25, 26.

1841. *Pleurotoma violacea*, Mighels, Proc. Boston Soc. Nat. Hist., vol. i, p. 50.

1842. *Defrancia cylindracea*, Möller, Ind. Moll. Groenl., p. 13.

1863. *Mangelia violacea*, Jeffreys, Rep. Brit. Assoc. (Trans.), Cambridge, p. 77.

1870. *Bela violacea*, Gould, Rep. Inv. Mass., ed. 2, p. 353, fig. 622.

1871. *Pleurotoma violacea*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 357.

1878. *Bela violacea*, G. O. Sars, Moll. Reg. Arct. Norv., p. 238, pl. xvii, fig. 2.

1884. *Bela violacea*, Mörch and Poulsen, MS. List in Geol. Mus., Copenhagen, no. 43 (unpublished).

1884. *Pleurotoma bicarinata*, var. *violacea*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 320.

1893. *Defrancia violacea*, A. Bell, Proc. Roy. Phys. Soc. Edinb., vol. xii, p. 22.

1899. *Bela bicarinata*, var. *violacea*, Posselt, Medd. om. Grönl., vol. xxiii, p. 156.

1910. *Bela violacea*, Odhner, Kongl. Svensk. Vet.-Akad. Handl. Stockholm, vol. vii, p. 11.

Specific Characters.—Shell small, short, sub-fusiform, whorls 5—6, but slightly angulated, the last about two-thirds the total length, ornamented by numerous, indistinct longitudinal ribs, stronger on the upper whorls but dying out on the lowest, and by very fine spiral striæ, producing obscure clathration; spire short, with an obtuse apex; suture well-marked; mouth oblong, angulate above; canal wide, very short.

Dimensions.—L. 8 mm. B. 4 mm.

Distribution.—Recent: Finmark, Lofoten Islands, Iceland, Greenland, north-east America.

Fossil: Butleyan Crag: Butley (A. Bell). Icenian: Bramerton, Horstead. Iceland Crag.

Pleistocene: Bridlington and Scotland, fairly common; Uddevalla.

Remarks.—The only occurrence in the Red Crag of this northern *Bela* hitherto recorded is that by Mr. A. Bell, who found it many years ago at Butley. The specimen here figured is from the Icenian deposit at Horstead. There are several others, imperfect, under this name in the Norwich Castle Museum which were obtained at Bramerton. There seems some difference of opinion as to the correct position of this form, Dr. Posselt considering it a variety of *B. bicarinata*; generally, however, it has been considered a distinct species.

Bela Odhneri, sp. nov. Plate XXXII, figs. 19, 20.

1846. *Tritonium turricula,* Lovén, Kongl. Svensk. Vet.-Akad. Forh., vol. iii, p. 84.
1878. *Bela assimilis,* G. O. Sars, Moll. Reg. Arct. Norv., p. 231, pl. xxiii, fig. 8.
1899. *Bela nobilis,* var. *assimilis,* Posselt, Medd. om Grönl., vol. xxiii, p. 149.
1905. *Bela turricula assimilis,* Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 235, pl. lxxxii, fig. 2.
1912. *Bela turricula,* var. *assimilis,* Dautzenberg et Fischer, Camp. Scient. Pr. Monaco., vol. xxxvii (Mollusques), p. 42.

Specific Characters.—Shell fairly solid, fusiform, turreted; whorls 7, nearly flat, strongly carinated, the last tumid, about as long as the spire, excavated below; ornamented by about fifteen strong longitudinal costæ which do not reach the canal and are nearly as wide as the spaces between them; intersected by raised and unequal spiral ridges, the upper one forming a continuous margin to the whorls; suture deep; mouth oval; outer lip obtusely angulated by the keel; inner lip forming a glaze on the columella; canal open, exserted; columella tortuous and excavated.

Dimensions.—L. 14 mm. B. 7 mm.

Distribution.—Recent: Finmark, Lofoten Islands, Kara Sea, Greenland.

Fossil: Coralline Crag: Boyton. Newbournian: Foxhall. Butleyan: Butley.

Remarks.—The fossil from Butley here figured has been identified by Dr.

Odhner with the *B. assimilis* of Prof G. O. Sars, and he has sent me a typical specimen from the Stockholm Museum, with which he considers it to correspond. The latter authority says that this shell approaches nearest to *B. rugulata*, but differs from the latter in its more slender form, its stronger keel and its elongated spire. I adopt the reference of the Butley shell to Prof. Sars' species, *B. assimilis*, on Dr. Odhner's authority, but as that term was used by Wood in 1872 for a *Bela* from the middle glacial sands of Billockby, it is necessary to adopt for it another name. I dedicate it, therefore, to Dr. Odhner, in acknowledgment of his kind assistance in the comparison of this interesting group of Crag fossils with the typical specimens in the Museum at Stockholm, and in their identification with the northern species recognised by Scandinavian conchologists.

He informs me that the present shell is the typical *Tritonium turricula* of Lovén. Prof. Kobelt agrees with Prof. Sars, Messrs. Dautzenberg and Fischer, and Dr. Odhner, in considering it specifically distinct from *B. rugulata*. It belongs, however, to the *rugulata* group.

Bela Trevelyana (Turton).[1] Plate XXXII, figs. 30—33.

1834. *Pleurotoma Trevellianum*, Turton, Mag. Nat. Hist., vol. vii, p. 351.
1848. *Clavatula Trevelliana*, S. V. Wood, Mon. Crag Moll., pt. i, p. 63, pl. vii, fig. 14.
1853. *Mangelia (Bela) Trevelliana*, Forbes and Hanley, Brit. Moll., vol. iii, p. 452, pl. cxii, figs. 1, 2.
1867. *Pleurotoma Trevelyana*, Jeffreys, Brit. Conch., vol. iv, p. 398, pl. xci, fig. 8.
1878. *Bela Trevelyana*, G. O. Sars, Moll. Reg. Arct. Norv. p. 235, pl. xvi, fig. 13.
1884. *Bela Trevelyana*, Mörch and Poulsen, MS. list in Geological Museum, Copenhagen, no. 41 (unpublished).
1886–1901. *Bela Trevelyana*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 11, pl. viii, figs. 7—10, 1886; pt. iii, p. 91, 1901.
1899. *Bela Trevelyana*, Posselt, Medd. om Grönl., vol. xxiii, p. 154.
1900–1. *Bela Trevellyana*, Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 653, pl. xvi, fig. 20.
1905. *Bela Trevelyana*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 266, pl. lxxxv, figs. 19, 20.
1910. *Bela Trevelyana*, Odhner, Kongl. Svensk. Vet.-Akad. Handl. Stockholm, vol. vii, p. 10.
1912. *Bela reticulata*, Dautzenberg et Fischer, Camp. Scient. Pr. Monaco, vol. xxxvii (Mollusques), p. 46.

Specific Characters.—Shell ovato-fusiform, subventricose; whorls 6, rounded, distinctly but slightly keeled, the last much the largest; ornamented by numerous fine and inconspicuous longitudinal ribs, crossed by fine spiral striæ which decussate

[1] Messrs. Dautzenberg and Fischer consider, and possibly with reason, that the present species is identical with that described by Brown in 1828 (Ill. Conch. Gt. Brit., pl. xlviii, figs. 29, 30) as *Pleurotoma reticulata*, which name, by the strict law of priority, should be substituted for *B. Trevelyana*. The latter has been so widely and universally adopted for nearly a century, however, that it seems to me inexpedient to alter it. Jeffreys regarded Brown's name as "obsolete."

the surface of the shell; spire varying in length but generally short, regularly tapering, not turreted or scalar; suture slight, but little oblique; mouth ovato-oblong, ending in a short and open canal; outer lip obtusely angulated by the keel; inner lip forming a rather wide glaze upon the pillar.

Dimensions.—L. 10—16 mm. B. 5—8 mm.

Distribution.—*Recent:* northern coasts of Great Britain, Hebrides, Shetland and Orkneys, Dogger Bank. Norway from the Christiania Fiord to Finmark, Lofoten Islands. White Sea, Spitzbergen, Iceland, Newfoundland, Greenland, Gulf of St. Lawrence, Massachusetts, west coast of North America (P. Carpenter).

Fossil: Waltonian Crag: Walton - on - Naze, Little Oakley. Newbournian: Sutton, Waldringfield, Felixstowe. Butleyan: Hollesley, Butley. Icenian: Bramerton, Aldeby, Bulchamp, Thorpe (Suffolk), Aldeburgh. Iceland.

Pleistocene: Bridlington, common in the Clyde beds and elsewhere in Scotland, less so in Ireland; Uddevalla, Murman coast, Christiania region, Norway, and Canada; Gulf of Gascony (Dautzenberg and Fischer).

Remarks.—*B. Trevelyana*, a British species with an extended range principally northern, extending from Spitzbergen to the west coast of North America, is found at all horizons of the English Crag from the Waltonian to the Icenian. It is widely diffused also in the Pleistocene deposits of this country and of other northern regions. It may be easily distinguished from most other Crag Belas by its fine, inconspicuous and decussate sculpture. I have two specimens from Oakley, one 10 mm. and the other 16 mm. in length; the first of these represents the size of the typical British form.

In the Crag specimens both the sculpture and the keel are sometimes nearly or quite obsolete (possibly worn), especially on the lower whorls.

Bela pyramidalis (Ström). Plate XXVIII, fig. 1; Plate XXXII, figs. 1, 2.

1788. *Buccinum pyramidale*, Ström, K. Dansk. Vid. Selsk. Skrift., vol. iii, p. 297, fig. 22.

1838. *Fusus pleurotomarius*, Couthouy, Boston Journ. Nat. Hist., vol. ii, p. 107, pl. i, fig. 9.

1842–70. *Bela pleurotomaria*, Gould, Rep. Inv. Mass., ed. 1, p. 290, fig. 192, 1842; ed. 2, p. 355, fig. 625, 1870.

1846. *Tritonium pyramidale*, Lovén, Kongl. Svensk. Vet.-Akad. Forh., vol. iii, p. 145.

1869. *Pleurotoma* (*Bela*) *pyramidalis*, Mörch, Ann. Soc. Malac. Belg., vol. iv (Mémoires), p. 22.

1872. *Bela pyramidalis*, Dawson, Canadian Nat., new ser., vol. vi, p. 391.

1878. *Bela pyramidalis*, G. O. Sars, Moll. Reg. Arct. Norv., p. 222, pl. xvi, fig. 3.

1884. *Bela pyramidalis*, Mörch and Poulsen, MS. list in Geological Museum, Copenhagen, no. 33 (unpublished).

1886-1901. *Bela pyramidalis*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 22, 1886; pt. iii, p. 94, 1901.

1887. *Bela pyramidalis*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 159, pl. xxxii, figs. 14, 15.

1888–93. *Pleurotoma pyramidalis*, A. Bell, Rep. Brit. Assoc. (Bath), p. 135, 1888; Proc. Roy. Phys. Soc. Edinb., vol. xii, p. 22, 1893.

1905. *Bela pyramidalis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 259, pl. lxxxiii, fig. 23.

1910. *Bela pyramidalis*, Odhner, Kongl. Svensk. Vet.-Akad. Handl. Stockholm, vol. vii, p. 12.

Specific Characters.—Shell elongato-fusiform; whorls 7—8, convex, not distinctly carinate, the last about half the total length; ornamented by from 12—16 flexuous and oblique longitudinal costæ, sometimes strong and prominent, at other times nearly obsolete, generally disappearing on the body-whorl, and by fine but distinct spiral ridges; spire attenuate, regularly diminishing in size; suture deep; mouth pyriform, angulate above, short and fairly wide; outer lip gently curved, passing into a short and open canal; columella flexuous.

Dimensions.—L. 15—20 mm. B. 6—7·5 mm.

Distribution.—Recent: northern and Arctic seas, not known on the Norwegian coast to the south of Lofoten. Greenland, east coast of North America to Cape Cod, Jan Mayen, Iceland, the Faroes, Murman coast, White Sea, Spitzbergen, Barents Sea, Nova Zembla, Kara Sea, Arctic shores of Siberia.

Fossil: Newbournian Crag: Waldringfield, Foxhall, Felixstowe. Butleyan: Boyton, Butley, Hollesley.

Pleistocene: Arca-clay, Tapes-banks, Christiania region (Brøgger), Trondhjem (Øyen), Uddevalla, Murman coast, Siberia, Labrador (Friele).

Remarks.—Of this species two or three well-marked varieties occur in the Crag, one or more of them being found at all horizons from the Red to the Icenian.

The specimens now figured, which correspond most nearly with Prof. Sars' type-form, are from Waldringfield and Butley, but I have not found any of them at Oakley.

Of the shorter form, var. *semiplicata* of Sars, I have two from the latter place; it does not appear to be very common elsewhere. The ecostate variety, var. *læviuscula*, I only know from the Icenian deposits and as a Pleistocene fossil; it might be interesting to ascertain whether such a zonal classification can be confirmed by further research.

Var. **semiplicata**, G. O. Sars. Plate XXIX, figs. 34, 35; Plate XXXII, figs. 5, 6.

1842. *Defrancia Vahlii* (Beck), Möller, Ind. Moll. Groenl., p. 13.

1878. *Bela pyramidalis*, var. *semiplicata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 222, pl. xvi, fig. 4.

1886. *Bela pyramidalis*, var. *semiplicata*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 22.

1887. *Bela pyramidalis*, var. *semiplicata*, Aurivillius, Vega Exped., Vet. Iakt., vol. iv, p. 349.

1899. *Bela pyramidalis*, var. *Vahlii*, Posselt, Medd. om Grönl., vol. xxiii, p. 161.

1905. *Bela pyramidalis*, var. *semiplicata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 259, pl. lxxxiii, fig. 22.

Varietal Characters.—Smaller than the type and generally more ventricose, with a shorter spire.

Dimensions.—L. 12—15 mm. B. 4—6 mm.

Distribution.—Recent : northern seas.

Fossil : Coralline Crag : Boyton. Waltonian : Little Oakley. Newbournian : Sutton, Foxhall. Butleyan : Boyton, Butley. Icenian : Bramerton.

Remarks.—This form, first described by Prof. G. O. Sars as a distinct variety of *B. pyramidalis*, has been since recognised as such by Mr. Friele, Prof. Kobelt and others. The latter states that it has been identified by Knipowitsch with the Greenland *B. Vahlii*, Beck. Mr. Friele, also considering that species to be identical with *B. pyramidalis*, says the present variety was found to be more abundant than the one last described, in the region investigated by the Norwegian Expedition.

In the specimen figured by Prof. Sars, the longitudinal costæ are confined to the upper whorls as they are in some of those in the later zones of the Red Crag; in the identified examples from Oakley, on the contrary, they extend nearly to the base of the shell as in Sars' type.

This feature cannot, therefore, be relied on as a varietal characteristic; the best distinction seems to be that the one is smaller and has a shorter spire than the other.

The present variety seems to agree with the shell described as *Pleurotoma nebula* in Wood's 3rd Supplement of the Crag Mollusca (p. 4, fig. 7). The longitudinal costæ and the spiral ridges are stronger in the Crag shells than in those figured as *B. pyramidalis* by Profs. G. O. Sars and Kobelt, but Mr. Friele, to whom one of my specimens was submitted, considered it to be the same.

Var. **læviuscula,** nov. Plate XXXII, figs. 3, 4.

1872. *Bela pyramidalis,* S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 43, pl. vii, fig. 22.

Varietal Characters.—Differs from the varieties before described in that their distinguishing sculpture is wanting or obsolete; in Recent specimens, however, the lines of growth are distinctly shown.

Dimensions.—L. 14 mm. B. 6 mm.

Distribution.—Recent : Spitzbergen.

Fossil : Icenian Crag : Aldeby, Yarn Hill, Dunwich. Isle of Man. Wexford gravels.

Pleistocene : March gravels, Scotland.

Remarks.—Many years ago I found several specimens of this form in a quantity of shelly gravel thrown up during the construction of the present station of the

Great Eastern Railway at March. They were identified by Wood as a variety of *B. pyramidalis*, one of them being figured by him under that name. Since then similar fossils have been obtained from several localities in the Icenian Crag, and Mr. A. Bell informs me that they have been met with also fossil in the Wexford gravels and in the Isle of Man. They correspond more or less nearly with a Recent example from Spitzbergen I have received from the Zoological Museum at Stockholm which is here figured. *B. pyramidalis* has been recorded from the Pleistocene deposits of Bridlington and Kelsey Hill, but to which variety the specimens there obtained belong I do not know.

Bela borealis (Reeve). Plate XXXII, figs. 12, 13.

1845. *Pleurotoma borealis*, Reeve, Conch. Icon., vol. i (Pleurotoma), pl. xxxi, fig. 277 (*P. borealis* in index, *P. scalaris* in plate).
1884. *Bela borealis*, Mörch and Poulsen, MS. list in Geol. Mus., Copenhagen, no. 39 (unpublished).
1905. *Bela decussata*, var. *viridula*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 255, pl. lxxxiv, fig. 8 (*Bela borealis* in plate).

Specific Characters.—Shell elongato-fusiform; whorls slightly convex, obtusely angulate, the last much the largest, three-fourths the total length; clathrated by inconspicuous but regular spiral lines and numerous close-set longitudinal costæ which die out on the body-whorl; spire short and conical; suture slight but distinct; mouth long, oval, angulate above, ending in a short canal which turns slightly to the left; outer lip thin, regularly curved, not expanded; inner lip forming a rather wide glaze on the columella.

Dimensions.—L. 11—13 mm. B. 5 mm.

Distribution.—*Recent:* Greenland.

Fossil: Icenian Crag: Aldeby. Iceland.

Remarks.—The shell here figured is from the Icenian Crag of Aldeby, and belongs to the Jermyn Street collection. It seems to agree with some Dr. Ravn has sent me from the Pliocene of Iceland which were identified by Mörch and Poulsen with *B. borealis*, Reeve. I cannot say that the Crag fossil corresponds altogether either with Reeve's figure of that species or with that of Prof. Kobelt. I have no material available, however, to enable me to form any decided opinion as to the correctness of Mörch's identification or of ascertaining what the *P. borealis* of Reeve really was. Our Crag shell seems to be the same as the Iceland fossil, and I therefore adopt Mörch's name for it.[1]

[1] The nomenclature of this species seems to be in some confusion. Both Reeve and Kobelt use different names in their plates and their text. The latter considers *B. borealis* to be a synonym of *B. viridula*. Our shell differs considerably from G. O. Sars' figure of the latter.

Bela Nordgaardi, sp. nov. Plate XXXII, fig. 21.

1872. *Pleurotoma bicarinata,* S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 43, pl. vi, fig. 17.

Specific Characters.—Shell thin and fragile, ovato-fusiform; whorls 6, but slightly convex, not carinated, the last much the largest, three-fourths the total length, excavated below; spire short, regularly and rapidly diminishing in size; suture distinct but not deep; ornamented by numerous longitudinal ribs, nearly obsolete, closely crowded together, dying out on the body-whorl, and by very fine, delicate and inconspicuous spiral lines; mouth long, acutely angulate above, ending in a short, well-marked canal which turns slightly to the left; outer lip expanded, gently curved; inner lip forming a rather wide glaze; columella flexuous.

Dimensions.—L. 12 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Butleyan Crag: Butley.

Remarks.—The Butley fossil here figured is from the British Museum, where it has been labelled "*Pleurotoma carinata?*, purchased from Mr. R. Bell, 1888." It seems to be the same as the Butley shell described by Wood with some doubt as *P. bicarinata.* It is not the Italian *P. carinatum,* Philippi, however, = *Fusus modiolus,* Jan, nor do I think it is the *B. bicarinata* of Couthouy and of Scandinavian conchologists,[1] which is smaller, having two strong and prominent spiral costæ on each whorl, the upper one forming a distinct keel with a sloping shelf below the suture, having also an angulation of the mouth and the outer lip. In our fossil the whorls are simply convex, rounded and ecarinate; the spiral sculpture is not strong and bicarinate, but delicately multistriate.

Mr. A. Bell reported the true *P. bicarinata* from Butley in 1871 (Ann. Mag. Nat. Hist. [4], vol. vii, p. 356). As he does not know what has become of the specimen, I figure below a Recent shell for the guidance of future collectors.

I dedicate the present shell to Prof. Nordgaard, of Trondhjem, from whom I have received some friendly help in the identification of the northern species of Crag Mollusca. To some extent it resembles the figures of *B. simplex* given by Prof. G. O. Sars, but I do not think it can be referred either to that species or to the *B. schantarica* of Middendorff. It appears to be a special Crag form, to be distinguished by its excessively delicate sculpture and its non-carinated whorls.

Var. **ventricosa,** nov. Plate XXXII, figs. 22, 23.

Varietal Characters.—Differs from the last variety in its wide mouth, shorter spire and more tumid body-whorl.

[1] Jeffreys, moreover, expressed the opinion (Ann. Mag. Nat. Hist. [4], vol. xix, p. 328) that the Crag shell is not the *Pleurotoma bicarinata* of Couthouy.

Dimensions.—L. 10 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Butleyan Crag: Butley.

Remarks.—One of the specimens now figured is from the British Museum, where it has been labelled *Bela æqualis?*, S. V. W., the other was obtained by Mr. P. G. H. Boswell, both of them being from Butley. They seem to me, however, to approach more nearly that last described, than Wood's figure of the former,[1] and I prefer to regard them as a varietal form of it.

In some respects they resemble *B. decussata*, Couthouy, but not sufficiently, I think, to be associated with it.

Bela bicarinata (Couthouy, non Wood). Plate XXXII, fig. 27.

1839. *Pleurotoma bicarinata*, Couthouy, Boston Journ. Nat. Hist., vol. ii, p. 104, pl. i, fig. 11.
1841–70. *Pleurotoma bicarinata*, Gould, Rep. Inv. Mass., ed. 1, p. 281, fig. 186, 1841; ed. 2, p. 349, fig. 618, 1870.
1871. *Pleurotoma bicarinata*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 356.
1878. *Bela bicarinata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 237, pl. xvi, figs. 11, 12.
1886–1901. *Bela bicarinata*, Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 15, pl. viii, fig. 18, 1886; pt. iii, p. 92, 1901.
1899. *Bela bicarinata*, Posselt, Medd. om Grönl., vol. xxiii, p. 155.
1905. *Bela bicarinata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 261, pl. lxxxiii, fig. 14.

Specific Characters.—Shell minute, rather fragile, fusiform; whorls 5—6, convex, angulato-carinate, attenuated below, the last three-fifths the total length; spire short, with an obtuse apex; suture deep, subcanaliculate; ornamented by spiral ridges, two of them being more prominent than the rest, the upper one forming a distinct keel; mouth oblong, about half the length of the shell, slightly angulated by one of the ridges; canal short, open.

Dimensions.—L. 6—9 mm. B. 2—3 mm.

Distribution.—*Recent:* Norwegian coast, from Christiania Fiord to Finmark, Lofoten Islands; Greenland; Spitzbergen, Murman coast; New England coast.

Fossil: Butleyan Crag: Butley (A. Bell).

Pleistocene: Murman Coast, Spitzbergen (Knipowitsch).

Remarks.—I figure a Recent specimen for the guidance of collectors, to show wherein it differs from the form hitherto known under that name to students of the Crag. Gould states it may be easily distinguished by its two spiral ridges.

Bela plicifera (S. V. Wood). Plate XXXII, fig. 28.

1848. *Clavatula plicifera*, S. V. Wood, Mon. Crag Moll., pt. i, p. 64, pl. vii, fig. 15.

Specific Characters.—Shell small, ovato-fusiform; whorls 5 or 6, slightly

[1] Mon. Crag Moll., 1st Suppl., pt. i, p. 44, pl. iii, fig. 17, 1872.

convex, the last sub-tumid, two-thirds the total length, excavated below, sub-angulate above; ornamented by about 20 distinct longitudinal ribs, oblique or sigmoid, which do not reach the base of the shell, closely crowded together; intersected by fine spiral lines, clearly shown on the back of the canal; spire turreted, gradually diminishing in size; apex blunt; suture deep; mouth oval; canal short, turning slightly to the left.

Dimensions.—L. 7 mm. B. 4 mm.

Distribution.—*Fossil:* Newbournian Crag: Sutton.

Pleistocene: Bridlington.

Remarks.—The fossil here figured is from Mr. Headley's collection, and was found at Bridlington. In sculpture it agrees more or less nearly with an imperfect specimen from the Newbournian Crag of Sutton described by Wood, which cannot now be traced. The present shell, however, is smaller, and the spire is shorter in proportion. It corresponds to some extent with one figured by Mr. Friele as *Bela obliqua*, G. O. Sars,[1] as to which he says it is easily distinguished by its sigmoid ribs. Prof. Sars' original figure of *B. obliqua*[2] reproduced by Prof. Kobelt[3] is, however, materially different.

Genus **TARANIS**, Jeffreys, 1870.

Taranis Mörchii (Malm). Plate XXXII, fig. 34.

1863. *Trophon Mörchi*, Malm, K. Vet. Vitt.-Samh. Götheborg Handl., vol. viii, p. 130, pl. ii, fig. 15.
1870. *Taranis Morchi*, Jeffreys, Ann. Mag. Nat. Hist. [4], vol. v, p. 447.
1878. *Taranis Mörchii*, G. O. Sars, Moll. Reg. Arct. Norv., p. 220, pl. xvii, fig. 8.
1882. *Taranis Morchii*, Verrill, Trans. Conn. Acad., vol. v, p. 486, pl. lvii, fig. 18.
1884. *Daphnella* (*Taranis*) *Mörchii*, Tryon, Man. Conch. [1], vol. vi, p. 315, pl. xxix, fig. 66.
1887. *Taranis cirrata*, Kobelt, Martini und Chemnitz, Conch. Cab., ed. 2, vol. iv (Pleurotomidæ), p. 168, pl. xxxiii, fig. 10.
1892. *Taranis cirrata*, Locard, Coq. mar. côtes France, p. 112, fig. 100.
1901. *Taranis cirrata*, Friele, Norske Nordh. Exped. (Mollusca), pt. iii, p. 86.
1901. *Taranis cirrata*, Brøgger, Norges geol. undersøgelse, vol. xxxi, p. 658, pl. xvii, fig. 20.
1905. *Taranis cirrata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 323, pl. xciii, fig. 1.

Specific Characters.—(Of the Manxland specimen.) Shell minute, ovate, subfusiform; spire very short, turreted, rapidly diminishing in size, ending in an obtuse rounded apex; whorls 5, angulate, with a flattened shelf below the suture, the last ventricose, much the largest, three-fourths the total length, excavated below, the body-whorl being ornamented by sharp and prominent spiral ridges, two of which

[1] Norske Nordh. Exped. (Mollusca), pt. ii, p. 7, pl. xv, figs. 16, 17, 1886.
[2] Moll. Reg. Arct. Norv., p. 226, pl. xvi, fig. 6, 1878.
[3] Icon. schalentrag. europ. Meeresconch., vol. iii, p. 250, pl. lxxxiii, fig. 4, 1905.

appear on the whorls immediately above it, with finer ones in the spiral interspaces, squarely cancellated by strong longitudinal costæ, which are continuous, generally obliquely, across the shelf; suture deep; mouth wide, oval, angulated by the keel, ending in a very short and open canal which turns to the left; outer lip thin, rounded, expanded.

Dimensions.—L. 5 mm. B. 3 mm.

Distribution.—Recent: Norwegian coast, Christiania Fiord to Finmark, Lofoten Islands. Atlantic coasts of France, Mediterranean (Kobelt). Eastern coasts of North America.

Fossil: Isle of Man, Kirkmichael.

Pleistocene: Christiania region, Arca-clay, Isocardia- and Tapes-banks.

Remarks.—Considerable difference of opinion exists as to the correct nomenclature of the northern shell described by Malm as *Trophon* (now *Taranis*) *Mörchi*, some authorities identifying it with the Sicilian species *Pleurotoma cirratum* of Brugnone.[1] Assuming that Brugnone's figure correctly represents the latter, I am inclined to agree with Jeffreys, Prof. G. O. Sars and Mr. Friele, that the two are distinct. The fossil here described under the present name was found by the Rev. S. N. Harrison at Kirkmichael on the west coast of the Isle of Man.

It must be admitted that the figures given by the authorities here quoted do not always agree with one another, or with the Manxland specimen, either in form or sculpture, Malm's shell having a single prominent spiral ridge, as has that of Prof. Brøgger, while the one represented by Prof. G. O. Sars, subsequently reproduced by Tryon, Locard and Kobelt, shows two, as does Mr. Harrison's shell; on the other hand, the spire of the Manxland fossil is very short, approaching in this respect Sturany's *T. alexandrina*[2] (copied by Kobelt in 1905[3]) and Prof. Brøgger's *T. cirrata* with its single ridge. In most of the illustrations referred to, the longitudinal costæ are shown to be deflected obliquely as they cross the ridge, in zigzag fashion, while in the Manx fossil they are nearly straight.

I am inclined, however, on the whole, to regard such differences as varietal, grouping all the forms now in question except those of Brugnone and Sturany as varieties of one variable species.

Seguenza reported *Pleurotoma Mörchi* from the Sicilian Pleistocene of Monte Pellegrino and Ficarazzi, and from the Upper Pliocene of Altavilla and Caltabiano; whether he was referring to Brugnone's *P. cirratum*, which he describes as "rarissimo fossile de Ficarazzi," or to Malm's shell, I am unable to say.

The generic term *Taranis* was proposed by Jeffreys in 1870; taking *T. Mörchi* as the type, he distinguishes it as being without an operculum, having a very short canal and peculiar sculpture.

---

[1] Mem. Pleur. foss. Palermo, p. 17, fig. 9, 1862.

[2] Moll. Pola, p. 11, pl. i, figs. 8, 9, 1896.

[3] *Op. cit.*, p. 325, pl. xciii, fig. 5, 1905.

PLATE XXV.

Fig.		Page.
1.	*Neptunea despecta* (Linné). var. *intersculpta*, G. B. Sowerby. Yarn Hill. (Sedgwick Museum, Cambridge)	166
2.	var. *subantiquata*, Maton and Rackett. Bramerton. (Ipswich Museum)	163
3.	var. *decemcostata*, Say. Bramerton. (British Museum)	161
4.	var. *carinata*, Pennant. Little Oakley. (Harmer Collection)	162
5.	var. *decemcostata*, Say. Little Oakley. (Harmer Collection)	161
6.	*Sipho gracilis* (Da Costa). var. *convoluta*, Jeffreys. Waldringfield. (Harmer Collection)	178
7.	ditto. Recent. (Tomlin Collection)	178
8.	*Sipho Herendeenii* (Dall). Little Oakley. (Harmer Collection)	184
9.	Ditto. Recent, Behring Sea. (British Museum)	184
10.	*Sipho hirsutus* (*?*) Jeffreys. Butley. (Harmer Collection)	201
11.	*Sipho togatus* (Mörch). Recent, Vega expedition. (Stockholm Museum)	180
12.	Enlargement of part of fig. 11	180
13.	*Trophon truncatus* (Ström). var. *Harmeri*, A. Bell. Cranstal Point, Isle of Man. (Harrison Collection)	201

1
2
1
3
6
4
7
5
5
10
13
12
10
8
9
11

PLATE XXVI.

Fig.		Page.
1.	*Pleurotoma turricula* (Brocchi). Scaldisien, Antwerp. (Harmer Collection)	203
2.	Ditto. Little Oakley. (Harmer Collection)	203
3.	var. *antwerpiensis*, Vincent. Little Oakley. (Harmer Collection)	205
4.	ditto. Little Oakley. (Harmer Collection)	205
5.	*Pleurotoma inermis*, Partsch. Boyton. (British Museum)	207
6.	var. *nuda*, S. V. Wood. Boyton. (Jermyn Street Museum)	207
7.	*Pleurotoma* (*Hemipleurotoma*) *denticulata* (Basterot). Little Oakley. (Harmer Collection)	208
8.	Ditto. Miocene, Saubriguez. (Harmer Collection)	208
9.	*Pleurotoma* (*Hemipleurotoma*) *plebeia* (Sowerby). Little Oakley. (Harmer Collection)	209
10.	Ditto. Eocene, Barton. (Harmer Collection)	209
11.	*Pseudotoma intorta* (Brocchi). Waldringfield. (Moore Collection)	212
12.	Ditto. Scaldisien, Antwerp. (Harmer Collection)	212
13.	Ditto. Italian Pliocene. (Harmer Collection)	212
14.	Ditto. Miocene, Denmark. (Copenhagen Museum)	214
15.	var. *Morreni* (S. V. Wood). Little Oakley. (Harmer Collection)	213
16.	ditto. Waldringfield. (Ipswich Museum)	213
17.	*Pleurotoma Selysii*, De Koninck. Oligocene, Holland. (V. d. Gracht Collection)	206
18.	Ditto. Little Oakley. (Harmer Collection)	206
19.	*Pleurotoma* (*Hemipleurotoma*) *Gastaldii* (Bellardi). Little Oakley. (Harmer Collection)	209
20.	*Clavatula interrupta* (Brocchi). Waldringfield. (Ipswich Museum)	210
21.	*Genotia ramosa* (Basterot). Little Oakley. (Harmer Collection)	211
22.	Ditto. Miocene, Touraine. (Harmer Collection)	211

1
2
3
4
11
12
5
6
7
8
9
10
15
16
13
19
21
17
18
14
20
22

PLATE XXVII.

Fig.		Page.
1.	*Oligotoma ornata* (Defrance). Miocene, Touraine. (Harmer Collection)	216
2.	Ditto. Little Oakley. (Harmer Collection) . . .	216
3.	*Oligotoma decorata* (A. Bell). Waldringfield. (York Museum) .	217
4.	Ditto. Little Oakley. (Harmer Collection) . . .	217
5.	*Oligotoma festiva* (Döderlein). Scaldisien, Antwerp. (Harmer Collection)	216
6.	Ditto. Little Oakley. (Harmer Collection) . . .	216
7.	Ditto. Gedgrave. (York Museum)	216
8.	*Oligotoma pannus* (Basterot). Miocene, Touraine. (Harmer Collection)	215
9.	Ditto. Little Oakley. (Harmer Collection) . . .	215
10.	Ditto. Miocene, Touraine. (Harmer Collection) . . .	215
11.	Ditto. Little Oakley. (Harmer Collection) . . .	215
12.	*Oligotoma bipunctula* (S. V. Wood). Scaldisien, Antwerp. (Harmer Collection)	218
13.	Ditto. Little Oakley. (Harmer Collection) . . .	218
14.	Ditto. Scaldisien, Antwerp. (Harmer Collection) . .	218
15.	Ditto. Little Oakley. (Harmer Collection) . . .	218
16.	*Drillia icenorum* (S. V. Wood). Scaldisien, Antwerp. (Harmer Collection)	220
17.	Ditto. Boyton. (Sedgwick Museum, Cambridge) . .	220
18.	var. *elongata*, nov. Boyton. (York Museum) . .	221
19.	var. *speciosa*, nov. Gedgrave. (Jermyn Street Museum) .	222
20.	*Drillia Brocchii* (Bonelli). Italian Pliocene. (Turin Museum) .	219
21.	Ditto. Beaumont. (Harmer Collection) . . .	219
22.	*Drillia crispata* (Jan). Italian Pliocene. (Harmer Collection) .	226
23.	Ditto. Little Oakley. (Harmer Collection) . . .	226
24.	*Drillia sigmoidea* (Bronn). Italian Pliocene. (Harmer Collection) .	225
25.	Ditto. Newbourn. (Ogden Collection)	225
26.	var. *pliomagna*, Sacco. Waldringfield. (Ipswich Museum) .	226
27.	*Haedropleura septangularis* (Montagu). Waldringfield. (York Museum)	251
28.	*Drillia incrassata* (Dujardin). Italian Pliocene. (Harmer Collection) .	222
29.	var. *dertomagna*, Sacco. Little Oakley. (Harmer Collection) .	223
30.	var. *miominor*, Sacco. Waldringfield. (Ipswich Museum) .	223
31.	var. *Nysti*, nov. Little Oakley. (Harmer Collection) .	224
32.	var. *crassa*, A. Bell. Scaldisien, Antwerp. (Harmer Collection)	224
33.	*Drillia terebra* (Basterot). Little Oakley. (Harmer Collection) .	229

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
20
16
17
18
19
21
22
23
24
25
26
27
28
29
30
31
32
33

PLATE XXVIII.

Fig.		Page.
1.	*Bela pyramidalis*, Ström (?). Boyton. (York Museum)	251
2.	*Drillia Kendalli*, sp. nov. Gedgrave. (York Museum)	229
3.	*Oligotoma bipunctula* (S. V. Wood). var. *proxima*, nov. Boyton. (British Museum)	219
4.	ditto. Waldringfield. (British Museum)	219
5.	*Oligotoma bipunctula* (S. V. Wood). Gedgrave. (Sedgwick Museum, Cambridge)	218
6.	Ditto. Little Oakley. (Harmer Collection)	218
7.	Ditto. Little Oakley. (Harmer Collection)	218
8.	Ditto. Little Oakley. (Harmer Collection)	218
9.	*Spirotropis modiola* (Jan). Little Oakley. (Harmer Collection)	230
10.	Ditto. Recent, Vardö. (Harmer Collection)	230
11.	Ditto. Boyton. (York Museum)	230
12.	Ditto. Gomer. (Sedgwick Museum, Cambridge)	230
13.	*Clathurella Leufroyi* (Michaud). Recent, Palermo. (Harmer Collection)	235
14.	Ditto. Little Oakley. (Harmer Collection)	235
15.	Ditto. Little Oakley. (Harmer Collection)	235
16.	*Clathurella purpurea* (Montagu). Little Oakley. (Harmer Collection)	231
17.	Ditto. Recent, St. Malo. (Harmer Collection)	231
18.	var. *minor*, Monterosato. Recent. (Harmer Collection)	234
19.	ditto. Little Oakley. (Harmer Collection)	234
20.	*Clathurella Philberti* (Michaud). Recent, Mediterranean. (Harmer Collection)	234
21.	Ditto. Little Oakley. (Harmer Collection)	234
22.	*Clathurella concinna* (Scacchi). Recent, Mediterranean. (Harmer Collection)	236
23.	Ditto. Little Oakley. (Harmer Collection)	236
24.	*Clathurella hystrix* (Jan). Little Oakley. (Harmer Collection)	240
25.	Ditto. Recent. (Harmer Collection)	240
26.	*Clathurella linearis* (Montagu). Recent. (Harmer Collection)	237
27.	Ditto. Little Oakley. (Harmer Collection)	237
28.	var. *intermedia?*, Forbes and Hanley. Butley. (Harmer Collection)	238
29.	var. *pallida*, Forbes and Hanley. Butley. (British Museum)	238
30.	*Clathurella Cordieri* (Payraudeau). Little Oakley. (Harmer Collection)	239
31.	Ditto. Recent. (Harmer Collection)	239
32.	*Bellardiella volutella* (Kiener). Boyton. (Sedgwick Museum, Cambridge)	242
33.	Ditto. Pleistocene, Sicily. (Harmer Collection)	242
34.	*Bellardiella gracilis* (Montagu). Recent. (Harmer Collection)	241
35.	Ditto. Gomer. (Sedgwick Museum, Cambridge)	241

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
34
29
30
31
32
33
35

PLATE XXIX.

Fig.		Page.
1.	*Bellardiella stria* (Calcara). Monte Pellegrino. (Harmer Collection) .	243
2.	Ditto. Little Oakley. (Harmer Collection) . . .	243
3.	*Haedropleura septangularis* (Montagu). Recent. (Harmer Collection)	251
4.	Ditto. Little Oakley. (Harmer Collection) . . .	251
5.	var. *secalina* (Philippi). Recent. (Harmer Collection) .	253
6.	ditto. Little Oakley. (Harmer Collection) . .	253
7.	*Haedropleura rufa* (Montagu). Recent, Weymouth. (Holmes Collection)	253
8.	Ditto. Little Oakley. (Harmer Collection) . . .	253
9.	var. *Ulideana* (Thompson). Recent. (Harmer Collection) .	254
10.	ditto. Little Oakley. (Harmer Collection) . .	254
11.	*Mangilia dubia*, sp. nov. Boyton. (Sedgwick Museum, Cambridge) .	246
12.	*Mangilia albida* (Deshayes). Little Oakley. (Harmer Collection) .	247
13.	*Mangilia costata* (Donovan). Little Oakley. (Harmer Collection) .	244
14.	var. *coarctata* (Forbes). Little Oakley. (Harmer Collection) .	245
15.	*Mangilia cærulans* (Philippi). Recent, Mediterranean. (Harmer Collection)	246
16.	Ditto. Little Oakley. (Harmer Collection) . . .	246
17.	*Mangilia ambigua* (Brugnone). Altavilla. (Harmer Collection) .	250
18.	Ditto. Little Oakley. (Harmer Collection) . . .	250
19.	*Mangilia indistincta*, Monterosato. Tyrrhenian Sea. (Tomlin Collection)	250
20.	Ditto. Little Oakley. (Harmer Collection) . . .	250
21.	*Mangilia Smithii* (Forbes). Recent, Madeira. (Harmer Collection) .	248
22.	Ditto. Little Oakley. (Harmer Collection) . . .	248
23.	*Raphitoma mitrula* (S. V. Wood). Little Oakley. (Harmer Collection)	269
24.	Ditto. Little Oakley. (Harmer Collection) . . .	269
25.	Ditto. Little Oakley. (Harmer Collection) . . .	269
26.	*Raphitoma striatula*, sp. nov. Little Oakley. (Harmer Collection) .	270
27.	*Raphitoma hispidula* (Bellardi). Italian Pliocene. (Harmer Collection)	260
28.	*Raphitoma similis* (Nyst). Scaldisien, Antwerp. (Harmer Collection)	259
29.	Ditto. Little Oakley. (Harmer Collection) . . .	259
30.	*Raphitoma turgida* (Forbes). Gomer Pit. (Sedgwick Museum, Cambridge)	267
31.	*Raphitoma tenuistriata* (A. Bell). Little Oakley. (Harmer Collection)	263
32.	Ditto. Little Oakley. (Harmer Collection) . . .	263
33.	var. *carinata*, nov. Little Oakley. (Harmer Collection) .	264
34.	*Bela pyramidalis* (Ström) var. *semiplicata*, G. O. Sars. Boyton. (British Museum)	296
35.	Ditto. Butley. (York Museum)	296
36.	*Raphitoma megastoma* (Brugnone). Italian Pliocene. (Harmer Collection)	267
37.	Ditto. Little Oakley. (Harmer Collection) . . .	267

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
23
24
25
26
19
20
27
28
29
30
21
22
31
32
33
34
35
36
37

PLATE XXX.

Fig.		Page.
1.	*Raphitoma harpula* (Brocchi). Italian Pliocene. (Harmer Collection)	255
2.	Ditto. Little Oakley. (Harmer Collection) . . .	255
3.	*Raphitoma senilis* (S. V. Wood). Waldringfield. (Ipswich Museum) .	264
4.	*Raphitoma Garlandi*, sp. nov. Little Oakley. (Harmer Collection) .	264
5.	*Raphitoma Woodii*, sp. nov. Boyton. (Sedgwick Museum, Cambridge)	265
6.	*Raphitoma Smith-Woodwardi*, sp. nov. Boyton. (British Museum) .	266
7.	*Raphitoma plicatella* (Bellardi). Little Oakley. (Harmer Collection) .	258
8.	*Raphitoma attenuata* (Montagu). Recent. (Harmer Collection) .	256
9.	Ditto. Little Oakley. (Harmer Collection) . . .	256
10.	var. *tenuicosta* (Brugnone). Gedgrave. (Norwich Museum) .	257
11.	ditto. Scaldisien, Holland. (Tesch Collection) . .	257
12.	var. *gracilior* (A. Bell). Gedgrave. (York Museum) . .	257
13.	var. *notata* (A. Bell). Little Oakley (Harmer Collection) .	258
14.	*Raphitoma nebula* (Montagu). Recent. (Harmer Collection) .	272
15.	Ditto. Little Oakley. (Harmer Collection) . . .	272
16.	Ditto. Recent. (Harmer Collection)	272
17.	Ditto. Little Oakley. (Harmer Collection) . . .	272
18.	Ditto. Recent. (Harmer Collection)	272
19.	Ditto. Little Oakley. (Harmer Collection) . . .	272
20.	var. *elongata*, Jeffreys. Recent. (Harmer Collection) .	273
21.	ditto. Little Oakley. (Harmer Collection) . .	273
22.	*Raphitoma valida*, sp. nov. Walton-on-Naze. (British Museum) .	265
23.	Ditto. Little Oakley. (Harmer Collection) . . .	265
24.	*Raphitoma nebula*, var. *Ginnaniana* (Risso). Recent. (Harmer Collection)	273
25.	Ditto. Little Oakley. (Harmer Collection) . . .	273
26.	var. *delicatula*, nov. Little Oakley. (Harmer Collection) .	274
27.	*Raphitoma curtistoma* (A. Bell). Gedgrave. (York Museum) .	271
28.	Ditto. Little Oakley. (Harmer Collection) . . .	271
29.	Ditto. Little Oakley. (Harmer Collection) . . .	271
30.	*Raphitoma brachystoma* (Philippi). Recent. (Harmer Collection) .	261
31.	Ditto. Gedgrave. (Sedgwick Museum, Cambridge) . .	261
32.	*Raphitoma nana* (Scacchi). Recent, Palermo. (Brugnone Collection) .	268
33.	Ditto, var. Gomer pit. (Sedgwick Museum, Cambridge) . .	268
34.	Ditto, var. Altavilla. (Brugnone Collection) . . .	268
35.	*Raphitoma lævigata* (Philippi). Recent. (Harmer Collection) .	274
36.	var. *minor*, Jeffreys. Recent. (Harmer Collection) . .	274
37.	ditto. Little Oakley. (Harmer Collection) . .	274
38.	*Raphitoma Payraudeaui* (Deshayes). Sutton. (Norwich Museum) .	262
39.	*Clathurella linearis* (Montagu), var. *æqualis* (Jeffreys). Sutton. (Norwich Museum)	238
40.	*Drillia emendata* (Monterosato). Ficarazzi. (Harmer Collection) .	227

1
2
3
4
5
6
7
8
9
10
11
12
14
15
16
17
18
19
13
20
21
22
23
24
25
38
26
27
28
29
30
31
39
32
33
34
35
36
37
40

PLATE XXXI.

Fig.		Page.
1.	*Bela scalaris* (Möller). Waldringfield. (Ipswich Museum)	278
2.	Ditto. Butley. (Ipswich Museum)	278
3.	Ditto. Isle of Man. (Harrison Collection)	278
4.	Ditto. Recent, northern seas. (Harmer Collection)	278
5.	*Bela rugulata*, Troschel. Little Oakley. (Harmer Collection)	279
6.	*Bela scalaris* (Möller). var. *ecarinata*, G. O. Sars. March gravels. (Harmer Collection)	280
7.	ditto. Little Oakley. (Harmer Collection)	280
8.	ditto. Recent, Karlsö. (Stockholm Museum)	280
9.	var. *abyssicola*, Friele. Butley. (Harmer Collection)	280
10.	ditto. Recent. (Stockholm Museum)	280
11.	*Bela rugulata*, Troschel. Boyton. (British Museum)	282
12.	Ditto. Recent. Greenland. (Stockholm Museum)	282
13.	var. *scalaroides*, G. O. Sars. Recent, northern seas. (Stockholm Museum)	283
14.	ditto. Hollesley. (Harmer Collection)	283
15.	var *Schneideri*, nov. Little Oakley. (Harmer Collection)	284
16.	ditto. Boyton. (Crowfoot Collection)	284
17.	*Bela nobilis* (Möller). Boyton. (Crowfoot Collection)	281
18.	Ditto. Little Oakley. (Harmer Collection)	281
19.	Ditto. Recent, Iceland. (Stockholm Museum)	281
20.	Ditto. Butley. (Harmer Collection)	281
21.	Ditto. March gravels. (Harmer Collection)	281
22.	*Bela rugulata*, Troschel, var. *bergensis*, Friele. Bramerton. (Norwich Museum)	284
23.	Ditto. Recent, Iceland. (Stockholm Museum)	284
24.	*Bela decussata* (Couthouy). Recent, Greenland. (Stockholm Museum)	289
25.	Ditto. East Runton. (Norwich Museum)	289
26.	Ditto. Bridlington. (Headley Collection)	289
27.	var. *inflata*, Posselt. Bridlington. (Headley Collection)	289
28.	var. *conoidea*, G. O. Sars. Recent, Finmark. (Stockholm Museum)	290
29.	ditto. Bramerton. (Norwich Museum)	290
30.	*Bela mitrula* (Lovén). Recent, Tromsö. (Harmer Collection)	286
31.	Ditto. Bramerton. (Norwich Museum)	286
32.	*Bela exarata* (Möller). Recent, Greenland. (Harmer Collection)	285
33.	Ditto. Bramerton. (Norwich Museum)	285

1
2
3
4
5
6
7
8
9
10
16
11
12
13
14
15
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

PLATE XXXII.

Fig.		Page.
1.	*Bela pyramidalis* (Ström). Waldringfield. (Ipswich Museum)	295
2.	Ditto. Butley. (Ipswich Museum)	295
3.	var. *læviuscula*, nov. Recent, Spitzbergen. (Stockholm Museum)	297
4.	ditto. Yarn Hill. (Harmer Collection)	297
5.	var. *semiplicata*, G. O. Sars. Oakley. (Harmer Collection)	296
6.	ditto. Bramerton. (Harmer Collection)	296
7.	*Bela turricula* (Montagu). Recent, Great Britain. (Harmer Collection)	276
8.	Ditto. March gravels. (Harmer Collection)	276
9.	Ditto. Bawdsey. (Norwich Museum)	276
10.	Ditto. Recent, Great Britain. (Harmer Collection)	276
11.	Ditto. Bramerton. (Sedgwick Museum, Cambridge)	276
12.	*Bela borealis* (Reeve). Pliocene, Iceland. (Mörch Collection)	298
13.	Ditto. Aldeby. (Jermyn Street Museum)	298
14.	*Bela harpularia* (Couthouy). Recent, Finmark. (Stockholm Museum)	287
15.	Ditto. Boyton. (Crowfoot Collection)	287
16.	var. *rosea* (Lovén). Recent, Bodybet. (Stockholm Museum)	288
17.	ditto. Boyton. (Crowfoot Collection)	288
18.	*Bela Dowsoni* (S. V. Wood). Waldringfield. (Harmer Collection)	291
19.	*Bela Odhneri*, sp. nov. Recent, Finmark. (Stockholm Museum)	293
20.	Ditto. Butley. (Harmer Collection)	293
21.	*Bela Nordgaardi*, sp. nov. Butley. (British Museum)	299
22.	var. *ventricosa*, nov. Butley. (British Museum)	299
23.	ditto. Butley. (Harmer Collection)	299
24.	*Bela gigantea* (Mörch). Shottisham. (York Museum)	291
25.	*Bela violacea* (Mighels). Recent. (Harmer Collection)	292
26.	Ditto. Horstead. (Norwich Museum)	292
27.	*Bela bicarinata* (Couthouy). Recent. (Harmer Collection)	300
28.	*Bela plicifera* (S. V. Wood). Bridlington. (Headley Collection)	300
29.	*Bela multistriata* (Jeffreys). Bridlington. (Headley Collection)	288
30.	*Bela Trevelyana* (Turton). Recent, Bernfiord. (Stockholm Museum)	294
31.	Ditto. Little Oakley. (Harmer Collection)	294
32.	Ditto. Butley. (Ipswich Museum)	294
33.	Ditto. Little Oakley. (Harmer Collection)	294
34.	*Taranis Mörchii* (Malm). Cronstal Point, Isle of Man. (Harrison Collection)	301

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

CALIF ACAD OF SCIENCES LIBRARY
3 1853 10007 2805